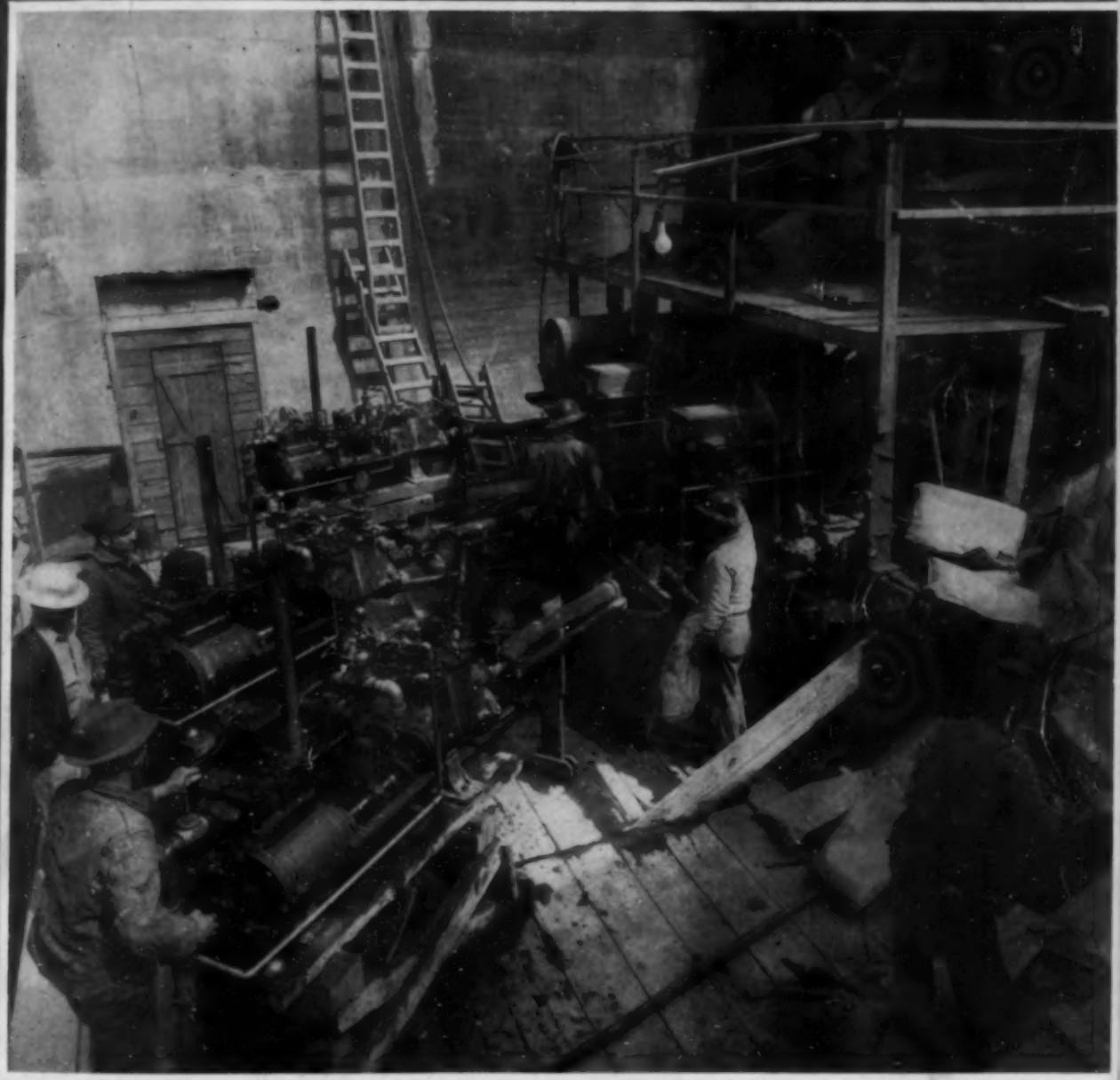
SEPTEMBER
1949

CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION



Ohio Favors Air-Entrained Concrete Highways—Litehiser, Barbee

Careened Drydock Passes Through Panama Canal Locks—Quirin

WASHINGTON, D. C.—HOST TO ASCE FALL MEETING, NOVEMBER 2-4, 1949

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JOBS that call for a permanent pile foundation call for Raymond equipment, Raymond experience and Raymond skill. From preliminary soil investigation to completed foundation, you can be sure that the Raymond organization will work swiftly, accurately and at minimum cost.

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Pictured above is Raymond's 1300-pile foundation for new Cole-plaza Trenton Company Building [illegible]

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SEPTEMBER 1949
VOLUME 19 NUMBER 9

CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION

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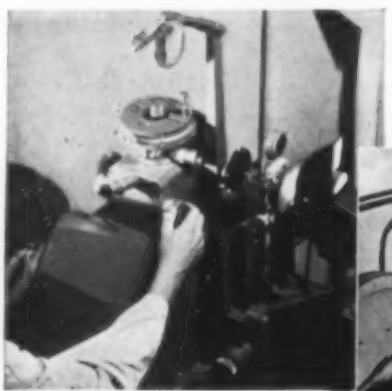
Announcing a New Research Laboratory and Foundry —

The Research Foundry is an integral part of the research laboratory and is housed in the same building. It is equipped with the most modern facilities for metallurgical research and development. Cut shows an experimental centrifugal casting operation.

To implement the expanded activities of our Research and Development Department in product and process research, we have built and equipped a new Research Laboratory and Foundry at Burlington where our General Offices and our Burlington plant are located. One of the largest and finest in the cast iron pressure pipe industry, its completion and recent dedication signalizes the 50th Anniversary of the founding of our Company.



The Metallographic Laboratory is devoted to the study of metal structure. Cut shows a Projection Microscope of the latest design. This precision instrument magnifies up to 4400 diameters.

Talbot Strip Tests—an acceptance test for centrifugally-cast pipe—are also conducted in the Physical Laboratory. A strip cut from pipe is under test and at left is the mechanized recorder which shows load and deflection.

The Chemical Laboratory is a service laboratory for research and development projects, and performs qualitative and quantitative analyses of a wide variety of materials. It also establishes standard analytical procedures for the laboratories at our several plants.

In the Physical Laboratory a 200,000 lb. universal testing machine of the most modern type is used for the Ring Crushing Test.

U.S. Pipe & Foundry Co.

GENERAL OFFICES: BURLINGTON, NEW JERSEY

American Society of Civil Engineers

Fall Meeting—Washington, D. C.

Hotel Statler

Nov. 2-4, 1949

Registration and Ticket Sales at Hotel Statler

Registration Desk Opens 9:00 a.m., Tuesday, November 1

Introduction to Washington, Wednesday, November 2

10 A.M. PRESIDENTIAL ROOM, HOTEL STATLER

Welcome by District of Columbia Section

BYRON BIRD, M. ASCE, President, District of Columbia Section, ASCE; Chief, Engineering Division, Washington, D.C., District, Corps of Engineer, U.S. Army.

Welcome to the District of Columbia

BRIG. GEN. GORDON R. YOUNG, M. ASCE, Engineer Commissioner, District of Columbia, Corps of Engineers, U.S. Army.

Response

FRANKLIN THOMAS, President ASCE, Dean of Students and Professor of Civil Engineering, California Institute of Technology, Pasadena, Calif.

Address

LUCIUS D. CLAY, Hon. M. ASCE, Maj. Gen. (ret), Former Commanding General, U.S. Military Government in Germany.

General Session—Role of the Engineer at Nation's Capital

WEDNESDAY AFTERNOON—2:30 P.M., PRESIDENTIAL ROOM, HOTEL STATLER

Presiding: Gail A. Hathaway, M. ASCE, Chairman, Technical Program Committee; Special Assistant to Chief of Engineers, Office, Chief of Engineers, Department of the Army, Washington, D.C.

Engineer-Contractor Cooperation, a Joint ASCE-AGC Activity

DWIGHT W. WINKELMAN, M. ASCE, 1948 President, AGC; President, D. W. Winkelman Co., Inc., Syracuse, N.Y.; Co-Chairman, Joint Cooperative Committee ASCE-AGC.

The Role of the Engineer in Washington as Related to the National Scene

PAUL WOOTON, Washington Member, Editorial Board, Chilton Publications, Washington, D.C.

Planning the National Capital—General Objectives and Problems of Obtainment

U. S. GRANT, III, Assoc. M. ASCE, Maj. Gen. (ret), Chairman Emeritus, National Capitol Park and Planning Commission, Washington, D.C.

Social Activities, Wednesday, Nov. 2

12:00 MEMBERSHIP LUNCHEON

Congressional Room, Hotel Statler. All members, guests and ladies are invited.

Toastmaster

ARCHIE N. CARTER, Assoc. M. ASCE, General Chairman, Fall Meeting Committee; Manager, Highway Division, Associated General Contractors of America, Inc., Washington, D.C.

Special address

PAUL G. HOFFMAN, Administrator, Economic Cooperation Administration, Washington, D.C.

7:00 DINNER-DANCE

Congressional Room, Hotel Statler, Formal dress optional. Special tickets for dance only available for ASCE Juniors and members of ASCE Student Chapters.

General Excursion—White House

Immediately following the Wednesday afternoon General Session, an inspection of the White House is scheduled. All members, guests and ladies are welcome to make this personally conducted trip. See note under Excursions.

Sessions of Technical Divisions, Thursday Morning Nov. 3

All Technical Division Sessions will be held at the Hotel Statler

Hydraulics Division

9:30 A.M. CONGRESSIONAL ROOM

Presiding: Lorenz G. Straub, M. ASCE, Chairman, Executive Committee, Hydraulics Division; Director, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minn.

9:30 Sedimentation Program of the Federal Agencies

CARL B. BROWN, Assoc. M. ASCE, Head, Sedimentation Section, Soil Conservation Service, Department of Agriculture, Washington, D.C.

10:00 Hydrologic Program of the Federal Agencies

MERRILL BERNARD, M. ASCE, Chief, Climatological and Hydrologic Services, U.S. Weather Bureau, Washington, D.C.

10:30 Water Resources of the Middle East

A. L. WATHEN, Director of Engineering, U.S. Bureau of Indian Affairs, Washington, D.C.

City Planning Division

9:30 A.M. FEDERAL ROOM

Presiding: L. V. Sheridan, M. ASCE, Chairman, Executive Committee, City Planning Division; Consultant, City and Regional Planning, Indianapolis, Ind.

9:30 The New Towns Program in Britain Prepared by

T. C. COOTE, Senior Planning Officer, British Ministry of Town and County Planning.

Presented by

JACOB L. CRANE, M. ASCE, Consulting Engineer and Assistant to the Administrator, Housing and Home Finance Agency, Washington, D.C.

9:50 Urban Expansion—Problems and Opportunities in American Metropolitan Areas

C. MCKIM NORTON, Executive Vice-President, The Regional Plan Association, New York, N.Y.

10:10 Discussion

TRACY AUGUR, Urban Planning Officer, General Services Administration, Washington, D.C.

T. T. MCCROSKY, M. ASCE, Executive Director, Greater Boston Development Committee, Inc., Boston, Mass.

10:25 Symposium on the Comprehensive Plan for the National Capital and Environs

The Plan Contrasted with Other City Plans

HARLAND BARTHOLOMEW, M. ASCE, Harland Bartholomew and Associates, St. Louis, Mo.

Principal Features of the Plan

JOHN NOLEN, JR., Assoc. M. ASCE, Director of Planning, National Capitol Park and Planning Commission, Washington, D.C.

Techniques in Guiding Suburban Planning

F. W. TUEMMLER, Assoc. M. ASCE, Director of Planning, Maryland National Capitol Park and Planning Commission, Riverdale, Md.

Determining Conditions in Redevelopment Areas

WILLIAM H. CARY, JR., Director, Bureau of Public Health Eng., Health Department, District of Columbia, Washington, D.C.

Discussion

Surveying and Mapping Division

9:30 A.M. PAN AMERICAN ROOM

Presiding: George D. Whitmore, M. ASCE, Chairman, Executive Committee, Surveying and Mapping Division; Chief, Research and Technical Control Branch, U.S. Geological Survey, Washington, D.C.

9:30 International Cartography

ROBERT H. RANDALL, M. ASCE, Chief Examiner, Surveying and Mapping, U.S. Bureau of the Budget, Washington, D.C.

10:00 Discussion

ISAIAH BOWMAN, President Emeritus, Johns Hopkins University, Baltimore, Md.

Brig. Gen. HERBERT B. LOPER, Member of Photographic and Survey Section, Joint Staff, Department of Defense, Washington, D.C

10:45 National Geodesy and Topographic Mapping—Status and Program

L. O. COLBERT, M. ASCE, Director, U.S. Coast and Geodetic Survey, Washington, D.C.

W. E. WRATHER, Director, U.S. Geological Survey, Washington, D.C.

11:00 Surveys and Maps for Industry

PHILIP KISSAM, M. ASCE, Professor of Civil Engineering, Princeton University, Princeton, N.J.

11:30 Discussion

WALTER GREEN, Glenn L. Martin Company, Baltimore, Md.

CAPT. O. S. READING, M. ASCE, Chief, Research Section, Division of Photogrammetry, U.S. Coast and Geodetic Survey, Washington, D.C.

Power Division

9:30 A.M. SOUTH AMERICAN ROOM

Presiding: Milton G. Salzman, M. ASCE, Chairman, Executive Committee, Power Division; Hydraulic Engineer, Ebasco Services, Inc., New York, N.Y.

9:30 Hydroelectric Aspects of the Work of the Corps of Engineers

H. G. ROBY, M. ASCE, Chief, Hydro Power Branch, Engineering Division, Civil Works, Corps of Engineers, U.S. Army, Washington, D.C.

10:00 Experience of U.S. Bureau of Reclamation in Uplift in the Design of Masonry Dams

KENNETH B. KEENER, M. ASCE, Chief, Dams Engineering Division, U.S. Bureau of Reclamation, Denver, Colo.

11:00 Report of Subcommittee on Uplift in Masonry Dams

ROSS M. RIEGEL, M. ASCE, Chairman, Subcommittee on Uplift in Masonry Dams, Power Division; Head Civil Engineer, Design Department, TVA, Knoxville Tenn.

Structural Division

9:30 A.M. PRESIDENTIAL ROOM

Presiding: Craig P. Hazelet, M. ASCE, Chairman, Executive Committee, Structural Division; Hazelet and Erdal, Consulting Engineers, Louisville, Ky.

9:30 Design of Soap Lake Siphon

ROBERT SAILER, Assoc. M. ASCE, Civil Engineer, Bureau of Reclamation, Denver, Colo.

10:00 Reconstruction of the White House

W. E. REYNOLDS, M. ASCE, Commissioner, Public Buildings Administration, Washington, D.C.

Discussion

R. E. DOUGHERTY, Past-President, ASCE, Advisory Counsultant, New York Central System, New York, N.Y.

11:00 International Standardization of Timber Testing

L. J. MARKWARDT, M. ASCE, Assistant Director, Forest Products Laboratory, Madison, Wis.

Sessions of Technical Divisions—Thursday Afternoon, Nov. 3

Air Transport Division

2:00 P.M. PAN AMERICAN ROOM

Presiding: Alfred J. Ryan, M. ASCE, Chairman, Executive Committee, Air Transport Division; Consulting Engineer, Denver, Colo.

2:00 **Airports for Metropolitan Washington**

PHILLIPS MOORE, Director, Office of Airports, Civil Aeronautics Administration, Washington, D.C.

2:30 **Economic Basis for Airport Planning**

PAUL H. STAFFORD, Chief, Airport Planning Division and A. D'ARCY HARVEY, Chief, Research and Analysis Division, Civil Aeronautics Administration.

3:00 **The International Civil Aviation Organization**

PAUL A. SMITH, M. ASCE, Rear Adm., U.S.C. & G.S., U.S. Representative on ICAO Council, Montreal, Canada.

Construction Division

2:00 P.M. PRESIDENTIAL ROOM

Presiding: Elmer K. Timby, M. ASCE, Chairman, Executive Committee, Construction Division, Howard, Needles, Tammen and Bergendoff, New York, N.Y.

2:00 **Point Four Program of the United States**

HON. WILLARD L. THORP, Assistant Secretary of State, Washington, D.C.

2:30 **Technical Research in the Construction Industry**

C. F. RASSWEILER, Vice-President, Research and Development, Johns Manville Corp.

3:00 **Building Research in Canada**

ROBERT F. LEGGET, M. ASCE, Director of Building Research, Canadian National Research Council, Ottawa, Canada.

3:30 **The Civil Engineer's Place in the Building Construction Industry**

MASON C. PRICHARD, M. ASCE, Assistant to the Chief, Military Construction Division, Corps of Engineers, U.S. Army, Washington, D.C.

Sanitary Engineering Division

2:00 P.M. SOUTH AMERICAN ROOM

Presiding: John H. O'Neill, M. ASCE, Chairman, Executive Committee, Sanitary Engineering Division; Director, Division of Public Health Engineering, State Department of Health, New Orleans, La.

2:00 **Solving Pollution Problems in the Potomac River Basin**

HAROLD A. KEMP, M. ASCE, Director, Sanitary Engineering, District of Columbia, Washington, D.C.

2:30 **Hygiene of Housing**

M. ALLEN POND, Assistant Chief Engineer, U.S. Public Health Service, Washington, D.C.

3:00 **Aspects of Sanitary Engineering in Atomic Energy Production**

ARTHUR E. GORMAN, M. ASCE, Sanitary Engineer, Atomic Energy Commission, Washington, D.C.

3:30 **Analysis of Sanitary Engineering Research**

ROLF ELIASSEN, Assoc. M. ASCE, Head, Sanitary Engineering Department, Massachusetts Institute of Technology, Cambridge, Mass.

Highway Division

2:00 P.M. FEDERAL ROOM

Presiding: Harold G. Sours, Assoc. M. ASCE, Chairman, Executive Committee, Highway Division; Baldwin and Sours, Columbus, Ohio.

2:00 **Highway Problems in Metropolitan Washington—A Symposium by:**

WILLIAM F. CHILDS, JR., Chief Engineer, Maryland State Roads Commission, Baltimore, Md.

C. S. MULLEN, M. ASCE, Chief Engineer, Virginia Department of Highways, Richmond, Va.

J. N. ROBERTSON, Director of Highways, District of Columbia.

2:45 **National Systems of Interstate Highways**

THOMAS H. MACDONALD, Hon. M. ASCE, Commissioner, Bureau of Public Roads, Washington, D.C.

3:15 **Highway Planning in Turkey**

H. E. HILTS, Assoc. M. ASCE, Deputy Commissioner in Charge of Design, Bureau of Public Roads, Washington, D.C., and Chief, U.S. Highway Commission to Turkey.

Waterways Division

2:00 P.M. CONGRESSIONAL ROOM

Presiding: Commodore William O. Hiltabidle, Jr., M. ASCE, Member, Executive Committee, Waterways Division; Director, Construction Department, U.S. Navy, Washington, D.C.

2:00 **Problems of Subsidence, U.S. Naval Shipyard, Long Beach, Calif.**

COMMANDER LEWIS C. COXE, Public Works Officer, U.S. Naval Shipyard, Long Beach, Calif.

Social Activities—Thursday, Nov. 3

12:00 **General Membership Luncheon**

Congressional Room. Members, ladies and guests.

Presiding

CLIFFORD A. BETTS, M. ASCE, Civil Engineer, U.S. Forest Service.

Address by

DR. KARL T. COMPTON, Chairman, Research and Development Board, Department of Defense.

2:30 **Ladies' Excursion and Sightseeing Trip**

Includes visit to the National Art Gallery and other outstanding buildings and areas in the Nation's Capital.

7:00 **Stag Dinner-Smoker**

Engineer Center, Fort Belvoir, Va.

7:00 **Ladies' Dinner**

Informal. South American Room, Hotel Statler.

Presiding

MRS. GAIL A. HATHAWAY, Chairman, Women's Activities Committee.

Address by

MRS. THOMAS BURKE, President, Pan-American Liaison Committee of Women's Organizations, and Chairman of Latin American Peoples Mandate Committee. Subject: "Our Latin American Neighbors to the South."

Discussion

E. H. HARLOW, Assoc. M. ASCE, Frederick R. Harris, Inc., New York, N.Y.

L. A. PALMER, Head, Soil Mechanics Section, Bureau of Yards and Docks, U.S. Navy, Washington, D.C.

3:00 The St. Lawrence Seaway

FRANK P. FIFER, M. ASCE, Consultant to the Division Engineer, North Atlantic Division, Corps of Engineers, U.S. Army, New York, N.Y.

Discussion

J. P. GROWDON, M. ASCE, Chief Hydraulic Engineer, Aluminum Co. of America, Pittsburgh, Pa.

3:30 Plans for Comprehensive River Development

COL. WILLIAM WHIPPLE, JR., M. ASCE, District Engineer, Corps of Engineers, U.S. Army, Walla Walla, Wash.

Student Chapter Conference

TUESDAY, NOVEMBER 1, 1949

8:00 a.m. Registration—Second Floor, Hotel Statler

9:00 a.m. Assembly — Congressional Room, Hotel Statler

Instructions regarding excursions by Theodore M. Schad, Jun. ASCE, Chairman, Student Activities Committee for the Fall Meeting, and Engineer, Bureau of Reclamation, Washington, D.C.

9:30 a.m. Excursions

Transportation to be by bus, leaving the Statler Hotel promptly at 9:30 a.m., for the following trips:

Trip S-1. Highway Trip

Consists of an inspection of the Highway Research Laboratories of the Bureau of Public Roads at Arlington, luncheon at the Pentagon Building, and afternoon inspection trips to several highway, bridge, and building construction jobs in and near Washington.

Trip S-2. Mapping and Bureau of Standards

An inspection trip through the Arlington photogrammetric laboratory of the U.S. Geological Survey in the morning, with luncheon at the Pentagon Building, and the afternoon to be spent in an inspection trip through the research laboratories of the National Bureau of Standards.

Trip S-3. Sanitary Engineering Trip

An inspection trip through the Dalecarlia Filtration Plant of the District of Columbia water supply system, and through the Blue Plains Sewage Treatment Plant. Luncheon will be had en route at one of the government building cafeterias.

Trip S-4. Naval Laboratories Trip

A visit to the Naval Ordnance Laboratory at White Oaks, Md., followed by luncheon at the cafeteria there, and an afternoon trip to the David Taylor Model Basin at Carderock, Md.

All trips will terminate at approximately 5:00 p.m. at the Statler Hotel.

6:30 p.m. Dinner—Interior Department

To be held in the Dining Room, Interior Department Building, 18th & C Streets, N.W., Washington, D.C.

EVENING PROGRAM

Interior Department Auditorium, First Floor of the Interior Department Building, 18th & C Streets, N.W.

8:00 p.m. Welcome on behalf of D.C. Section by BYRON BIRD, President, D.C. Section, ASCE.

8:05 p.m. Response by delegates from local Student Chapters

8:10 p.m. Remarks by FRANKLIN THOMAS, President, ASCE

8:30 p.m. Special address

10:00 p.m. Adjournment

In addition, members of Student Chapters are invited to participate in all other events of the Fall Meeting.

Local Sections Conference

MONDAY AND TUESDAY OCT. 31—NOV. 1, 1949

9:30 a.m. Representatives of Local Sections of ASCE in the East Coast region will assemble in the Hotel Statler on Monday and Tuesday, October 31 and November 1, preceding the general meeting.

This conference, which primarily is for appointed delegates of the Sections, will be open to any who may be especially interested in the activities of ASCE Local Sections.

Twenty-six Sections will participate in this conference.

Many Excursions Arranged for Members and Guests

Excursion Wednesday, Nov. 2, 4:00 p.m.

1. **White House Tour.** At the conclusion of the Technical Program, an inspection tour is planned through the White House to view the plans and progress of its reconstruction. This tour is contingent upon whether it will be physically possible to make the inspection, as the status of the reconstruction at the time of the Fall Meeting will determine whether this tour is feasible.

Excursions Friday, Nov. 4

2. (9 a.m.) **Sightseeing Tour.** Beginning at the headquarters hotel a tour of public buildings in Washington will be made involving stops at the Capitol, Supreme Court, Congressional Library, Washington Monument, Lincoln Memorial, Jefferson Memorial, the Lee Mansion, the Tomb of the Unknown Soldier, the Pentagon Building, Washington National Airport, Arlington, Alexandria and Mount Vernon, Va., via the Mount Vernon Memorial Highway. A stop will be made for luncheon and the trip will end at 4:30 p.m. at the headquarters hotel.

3. (9:30 a.m. and 1:30 p.m.) **Sightseeing and City Planning Tour.** A tour of about 2½ hours' duration is scheduled to be run morning and afternoon to points of historical and governmental interest in the District of Columbia and vicinity, and also including points of special interest to members of the City Planning Division.

4. (9 a.m.) **Guided tours** of the world's foremost surveying and mapping agencies. Opportunity will be afforded to inspect the activities and map reproduction methods

of the following agencies:

U.S Army Map Service
U.S. Coast and Geodetic Survey
U.S. Forest Service
U.S. Geological Survey
U.S. Navy Hydrographic Office

5. (9 a.m.) **Construction, Highway and Structural Divisions Tour.** This tour is scheduled to afford an opportunity for the inspection of outstanding construction, highway and structural activities that are in progress in the District of Columbia and vicinity. It will involve stops to view the construction of the 14th Street Potomac River Bridge, a view of the Pentagon Highway network, the construction of the Shirley Memorial Highway, and returning via the Mt. Vernon Memorial Highway, the Washington National Airport, the K Street elevated highway and the Dupont Circle Underpass construction.

6. (9 a.m.) **Naval Ordnance Laboratory, White Oaks, Md.** The Naval Ordnance Laboratory is primarily a research and development activity of the Bureau of Ordnance, Navy Department, operated for the development of ideas for naval ordnance and to apply them with maximum effectiveness to the needs of the Navy. The plant, which was substantially completed in 1949, involves a capital investment of approximately 20 million dollars in property, plant and structures, plus 15 million dollars in equipment. It has many outstanding technical facilities which are available at no other place in the country. The tour will end at the headquarters hotel at 1:00 p.m., following luncheon at the Laboratory.

7. (1 p.m.) **David Taylor Model Basin.** A conducted tour of the David Taylor Model Basin is scheduled to afford an opportunity to view the facilities and activities of the David Taylor Model Basin, which is operated for the solution of research problems involving the design and operation of naval vessels and aircraft through the study of the performance of actual scale models under controlled conditions, and also to inspect the test facilities used for the solution of problems in hydrodynamics.

For members and guests who desire to vist both the Naval Ordnance Laboratory and the David Taylor Model Basin, a combined tour covering Tours 6 and 7 is also scheduled.

8. (9 a.m.) **Blue Plains Sewage Treatment Plant.** The sewage treatment plant of the District of Columbia, located at Blue Plains, D.C., on the banks of the Potomac River, is a primary plant with a rated capacity of 130 mgd of sewage, which, with new sedimentation and digestion tanks now under construction, will enable the plant to handle 173 mgd. A modern completely equipped laboratory for all routine and special analyses is operated in conjunction with the treatment plant.

CLEARANCE FOR PARTICIPATION IN TOURS 6 and 7: Any non-citizens desiring to participate in the tours to the Naval Ordnance Laboratory at White Oaks, Md., and the David Taylor Model Basin will have to obtain clearance from the Office of Naval Intelligence through their respective embassies.

Post-Convention Excursion

NOVEMBER 5 and 6

Following the ASCE Fall Meeting in Washington, D.C., a splendid two-day post-meeting tour to historic Williamsburg, Va., has been arranged. This tour will be by private motor coaches leaving the headquarters hotel at 8 a.m. on Saturday, proceeding via Falls Church, Bull Run Battlefield and Warrenton to Panorama, thence over the Skyline Drive in the Shenandoah National Park, the most scenic drive in the eastern United States; thence to Charlottesville, the University of Virginia, to Monticello, the home of Thomas Jefferson, to Richmond, the capital of Virginia, where an overnight stop will be made.

Following a tour of historic Richmond, the party will proceed to Williamsburg, where, through the restoration and reconstruction of representative buildings, private residences and gardens, there have been brought back to life those elements that have contributed so much to the dignity, charm, and historic significance of Colonial Williamsburg.

This tour has been especially arranged for the American Society of Civil Engineers and is conducted on an all-expense basis for transportation, meals and lodging at $43.50 per person. The trip will terminate at the headquarters hotel at 7:30 p.m. on Sunday, November 6.

All inquiries and requests for copies of the descriptive folder on this tour should be addressed to:

MR. RALPH L. PREBLE
Convention Manager
United States Travel Agency
807 15th Street, N.W.
Washington 5, D.C.

Hotel Accommodations and Meeting Headquarters

Make Hotel Reservations Early

The Statler Hotel in Washington, D.C., is the headquarters for the Fall Meeting of ASCE. Most events, unless otherwise noted, will be held in this hotel. All attending the meeting are urged to make requests for reservation of hotel accommodations as early as possible.

To assure accommodations at the Headquarters Hotel Statler, requests should be received by the Hotel Committee before October 12. Later applicants will be assigned to other nearby hotels.

Rates at the Hotel Statler start at $5.00 single and $8.00 double, with a rate of $9.50 for a double room with twin beds.

Typical Hotel Rates

HOTEL	SINGLE	DOUBLE
Statler	from $5.00	from $8.00
Ambassador	4.00	7.00
Carlton	6.00	9.00
Hamilton	3.50	6.00
Hay-Adams	4.50	6.50
Lafayette	5.00	7.00
Sheraton	4.85	7.85
Washington	5.00	9.00

Requests for reservations should be mailed to Vincent B. Smith, Chairman, Hotel Committee, c/o Sales Department, Hotel Statler, Washington 13, D.C. Mention the ASCE Meeting in all inquiries. For convenience use the reservation blank printed on page 93 of this issue. All requests will be acknowledged.

Information Desk

An information desk will be maintained on the mezzanine floor of the Hotel Statler from 9:00 a.m., Tuesday, November 1, throughout the days of the Meeting. Mail will be delivered to members at addresses given on registration or held at the registration desk. All undelivered mail will be forwarded to home addresses at the close of the meeting. A special message service will be in operation at the registration desk.

Women's Committee Room

A Women's Committee Room will be reserved as Ladies' Headquarters for the duration of the Fall Meeting. Here the ladies will find a convenient place for meeting their friends, planning their activities, playing bridge, etc. Members of the Ladies' Committee will be on duty to assist with advice on shopping and sightseeing. The ladies are invited to make full use of their headquarters.

Committee Chairmen

Archie N. Carter, *General Chairman*
Daniel C. Walser, *Vice-Chairman*

COMMITTEE	CHAIRMAN
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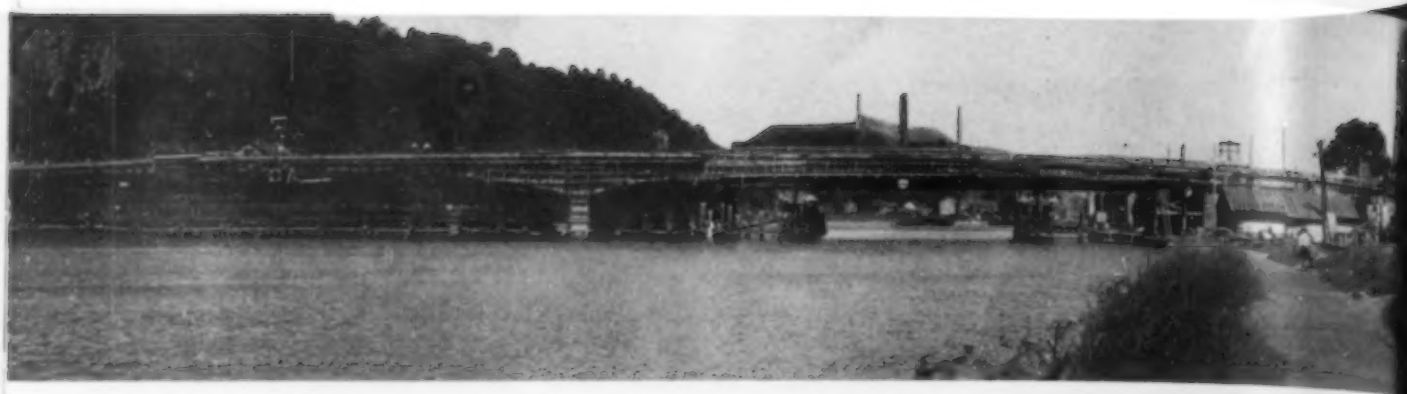
Committee to Cooperate with Other Sections	Charles J. Stevens
Student Activities	Theodore M. Schad
Transportation	S. E. Ridge
Entertainment	Clifford A. Betts
Women's Activities	Mrs. Gail A. Hathaway
Excursions	A. G. Fiedler
Finance	T. Ritchie Edmonston
Hotel and Registration	Vincent B. Smith
Publicity	Alfred C. Stiefel
Reception	Frank L. Weaver



FIRST CONTINUOUS-SPAN prestressed concrete bridge was designed by Gustave Magnel, M. ASCE, for Meuse River crossing near Namur, Belgium. This Sclayn Bridge has concrete girders cast in place and prestressed by 0.276-in.-dia wires assembled in cables 420 ft long, that is, full length of bridge between abutments. Compressive stress in concrete does not exceed 2,160 psi. See Fig. 1. Contractor is Enterprises Blaton-Aubert.

Prestressed Concrete Used for Boldly Designed Structures in Europe

E. R. SCHOFIELD, M. ASCE

Principal Assistant Engineer, Bureau of Engineering, Survey and Zoning, City of Philadelphia, Pa.

THOSE in charge of the Walnut Lane Bridge in Philadelphia, the first prestressed concrete bridge in the United States (see Mr. Schofield's article in CIVIL ENGINEERING for July 1949), felt that the engineers responsible for its design and construction should get first-hand knowledge of the methods used in Europe. Mr. Schofield headed a party of six engineers and contractors connected with the Walnut Lane Bridge who visited Belgium, France, Sweden, and England in June 1949. Here he briefs his observations of a variety of applications and techniques of prestressing. The illustrations are furnished by C. C. Zollman, Jun. ASCE, staff engineer of the Preload Corporation, New York, N.Y.

EUROPEAN STRUCTURAL ENGINEERS are now using prestressed concrete for bridges, buildings, hangars, dam ties, railroad ties, tanks, water pipes, aqueducts, sewers, poles, piles and runway paving. The necessity for the replacement of the many bridges destroyed during the war in Belgium and France has given great impetus to the use of prestressed concrete construction. In both these countries and in England, the demand for rapid replacement of the many buildings destroyed during the war has led to the building of factories for the prefabrication of prestressed concrete structural units. Prestressed concrete railroad ties were being made at all the plants visited because of the habit of invading armies of using wooden ties for firewood.

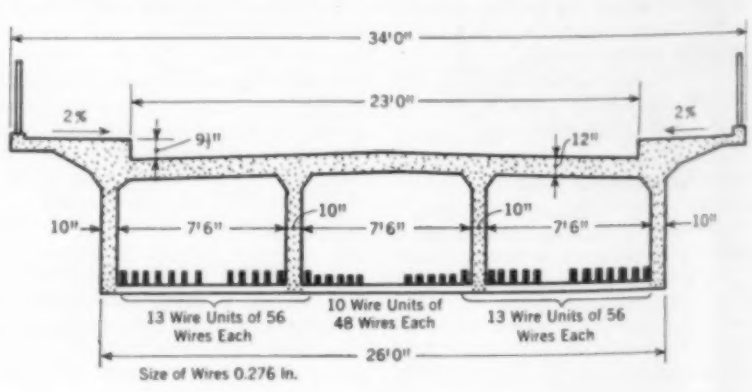
About ten systems of prestressing are used in Europe but only three are described in this article, that is, the Magnel-Blaton, Freyssinet, and Hoyer systems. In the Hoyer system many—up to a hundred—wires of $^{5}/_{64}$-in. diameter are prestressed before the concrete is placed around them. In the Stent modification (England) of the Hoyer system, large ($^{3}/_{16}$-in.) wires are used. This method is known as pre-tensioning. In the other two systems the prestressing wires are pulled through holes left in the concrete and stressed against the ends of the units by jacking after the concrete has set, a method known as post-tensioning. These two systems utilize wires with a maximum diameter of $^{1}/_{4}$ in. and as a general rule can be used for longer-span structures than can be built economically by the fine-wire method. All three methods are being employed extensively at the present time.

The basic requirement for prestressed concrete construction is the manufacture of good concrete, since the concrete design stress is generally 2,000 psi. At every plant visited, the concrete was of exceptional quality, 9,000 psi being obtained in 90 days at some plants. Proper grading of aggregates, low water-cement ratio, plenty of vibration, and careful curing are the operations emphasized in the preparation of this concrete.

Aggregates used at all the sites were gravel and sand except at Fontaine, France, where a small quantity of stone grit was added. Aggregates are carefully graded to obtain maximum density.

The amount of water used generally does not exeed 4 U.S. gal per sack of cement—just enough to develop complete hydration of the cement. This mix produces a harsh concrete without slump which cannot be poured, as this term is usually applied, and when the concrete is

FIG. 1. SCLAYN BRIDGE, designed by Professor Magnel, consists of single continuous-span box girder and was built to utilize existing pier and abutments. After prestressing, wire units will be encased in concrete for protection.



placed in the forms the full outline of each pebble is visible. Contractors in Europe are educated to use this very dry mix.

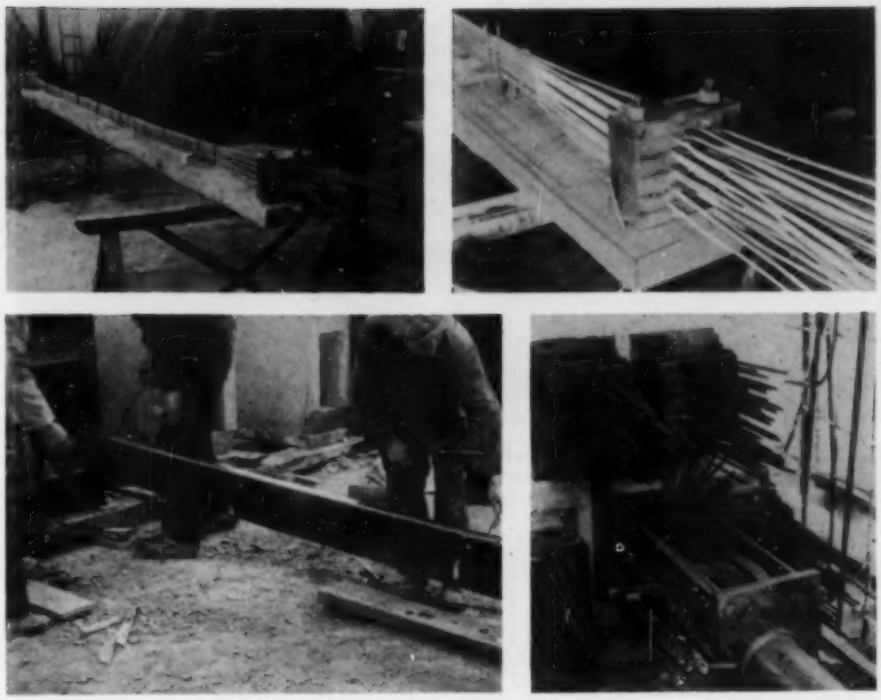
Such a harsh concrete requires full use of vibrators to completely fill the forms. In many cases the mix is too dry and dense for the use of internal vibrators and external vibrators must be used. External vibrators are employed regardless of whether the forms are of wood or of steel. At one plant in Stockholm the vibrators were spaced as close as 5 ft on centers. Vibration is continued until a film of moisture appears on the top surface, at which time vibration is discontinued and the top trowleled smooth.

Care Taken in Curing Concrete

Curing is done in several ways and sometimes in different ways in the same plant. In the field curing is accomplished by water spray and damp tarpaulins. In the Bjuggren factory in Stockholm, units are poured in a large concrete basin which is flooded with hot water at the end of the day's work. The water, which is at a temperature of 160 deg F, is drained off after 15 hours. At the Stent plant at Dagenham Dock, London, curing is done in live steam up to 18 hours at approximately 160 deg F. Concrete up to 8,000 psi in 18 hours has been obtained at this plant although the normal is 6,000 psi. General European practice seems to favor the use of high early strength cement.

The strength of prestressed concrete is due to the ability of the concrete and steel to take high stresses. With a design stress of 2,000 psi for concrete, the design stress used for steel is at least 125,000 psi. Such a stress is not obtainable in rolled steel but is available in cold drawn wire. The ultimate strength of the $^{5}/_{64}$-in. wires used in the Hoyer system is approximately 325,000 psi.

Great care is taken at all the plants visited to place the cables in the forms in such a manner that when stretched taut the wires are parallel to one another so that there is a space around each wire for either concrete or grout. During the stretching process, the wires are watched very carefully to insure that all take the same elongation and consequently the same stress. Professor Magnel stretches two wires at a time; Mr. Freyssinet's jacks handle 8 to 18 wires at a time; and the number of smaller wires handled at the Hoyer factories was not counted but probably runs up to a hundred. The wires in the Hoyer plants are so close together that they



CABLE ASSEMBLY (upper left) for prestressing concrete girder according to Magnel-Blaton system, consists of wires in multiples of eight drawn through hole formed in girder by tapered sheet-metal mandrel (lower left) cast in and later withdrawn by aid of jack. Wires are anchored at each end of girder by tier of sandwich plates (upper right), each plate anchoring eight $^{1}/_{4}$-in. wires. Wires are prestressed in pairs by 10-ton jacks (lower right) to 125,000 psi and are wedged into sandwich plates, which bear on steel bearing plate resting against end of girder.

appear to be touching each other, yet the cross-sectioned samples show the wires to be entirely surrounded by concrete. Careful laboratory measurement of the variation in stress among the many wires shows that this variation is not more than 5 percent.

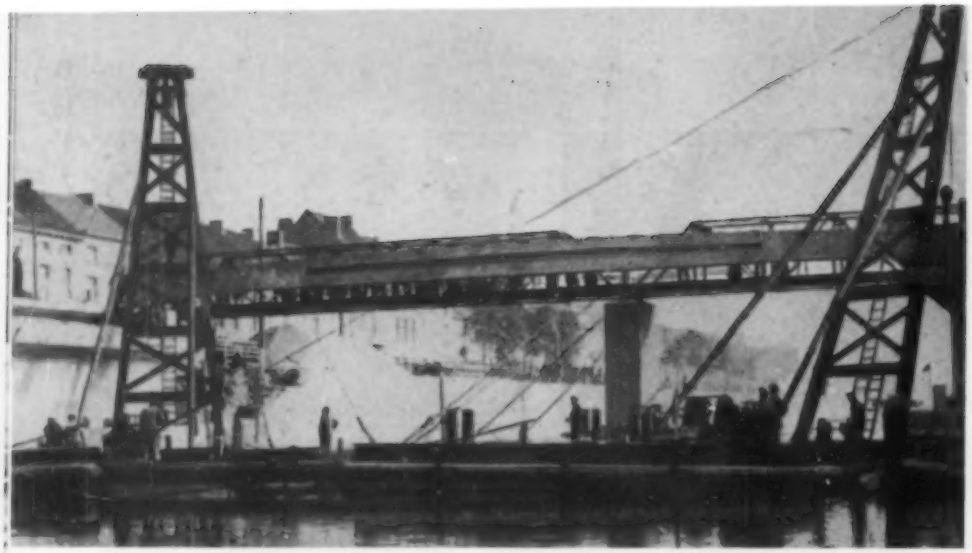
Belgian Method—Magnel-Blaton System

In the Magnel-Blaton system, devised by Prof. Gustave Magnel, M. ASCE, assemblies of $^{1}/_{4}$-in. wires are drawn through holes cast in the concrete girder, after the concrete has set. The wires, in layers of four each, are held in position in the beam by metal spacer-blocks and anchored by sandwich plates. A sandwich plate has grooves top and bottom for four wires; hence each sandwich plate holds and spaces eight wires. Each sandwich plate for this size of wire measures $6^{1}/_{4} \times 3^{9}/_{16} \times 1^{3}/_{8}$ in. thick. Wedges, when driven home in the tapered grooves, keep the prestressed wires from slipping, each wedge locking two wires. Enough sandwich plates are piled on top of one another to care for the number of wires used in each "cable."

Each bank of sandwich plates bears against a rectangular carbon-steel masonry plate with a rectangular hole in it narrower than the sandwich plates. This plate transmits the pull from the wires into the concrete and must be capable of resisting the compressive and bending stresses set up in it by the wires. Metal spacer blocks hold the wires in a predetermined position with respect to each other as well as in relation to the sides of the cable hole in the concrete. Blocks are spaced longitudinally about 5 ft apart, which distance is maintained by ties that also serve to hold the spacers in a position normal to the longitudinal axis of the hole.

In the Magnel-Blaton system, 10-ton jacks may be used to prestress the wires since only two wires are tight-

NO-SLUMP CONCRETE used in Europe for prestressed construction is so dry and harsh that individual pebbles stand out and generous use of vibrators is required for placing.



CONCRETE BEAM of DeSmet Bridge is lifted from barges into position over canal in Ghent, Belgium. According to Magnel-Blaton system, wires extending through beam will be prestressed before it is loaded. Forty-foot vehicular roadway will also carry trolley tracks.

ened at once. The wires are fastened in the cross-head bar of the jack by a wedging device similar to that described for the sandwich plates except that it is twice as large.

The hole through which the wires are pulled is formed in the concrete by the use of a hollow mandrel formed of sheet steel, which is withdrawn after the concrete has set. When some of the cables are parabolic in profile, a solid rubber form is used, which can be withdrawn without difficulty as tension at the end reduces the cross section and breaks the bond. The holes are filled with grout after the wires are stressed, thus insuring a bond between the cable and the concrete and protecting the wires against corrosion.

No technique or method is used until thoroughly tested in Professor Magnel's up-to-date laboratory at the University of Ghent. The contracting firm of Enterprises Blaton-Aubert, Brussels, which has built numerous prestressed concrete structures, has collaborated in developing the Magnel-Blaton system.

Magnel-Blaton System Used for DeSmet Road Bridge

In Ghent the DeSmet Road Bridge over the canal has a span of 94 ft 6 in. and carries a roadway 40 ft wide with trolley cars and two sidewalks 10 ft wide. Because the elevations of the roadway could not be raised nor the underclearance below the bridge decreased, the thickness from roadway surface to underclearance line was limited to 44 in. Professor Magnel stated there were two possible solutions to this problem—one, a rigid frame, and the other, a prestressed deck. Use of a rigid frame would have required provision for horizontal thrust at the abutments and would have had the further disadvantage of reducing the underclearance at the haunches.

The problem was solved by using simply supported prestressed concrete I-beams placed side by side and prestressed together transversely. Each beam is 20 in. wide with webs 7 in. thick. Prestressing was done by three cables in each beam, one containing 48 wires and two containing 24 wires each. The wires were prestressed to 135,000 psi, which induced a compressive stress in the concrete of 2,000 psi.

An alternate steel-girder bridge, designed for a special grade of steel, anticipated a deflection of $2^{3}/_{8}$ in. at the center of the span under full load. The measured deflection at the center of the prestressed concrete bridge under full load was $^{5}/_{16}$ in.

Belgian Textile Mill Covers $8^{1}/_{2}$ Acres

Another structure put up by the Magnel-Blaton system is the huge one-story textile factory covering $8^{1}/_{2}$ acres in Ghent, Belgium. All columns, girders, beams and roof slabs were precast in steel forms on the ground and lifted into position after prestressing. Main girders (100 of them) have a span of 72 ft and are supported on concrete brackets formed monolithically with the columns. Secondary beams (600 of them) have a span of 45 ft and rest on brackets cast on the main beams. Tertiary beams of 12-ft span are of reinforced concrete. Precast roof slabs are supported on the top flanges, and a suspended ceiling rests on the lower flanges of the tertiary beams. The space between is filled with rockwool insulation.

The use of steel molds for all members insured accuracy of dimension and fit, imparted a good surface finish and made it possible to erect this immense structure in one year with no more than 70 workmen at a time engaged on the job.

"Colcrete" was used here for the first time for the grouting in of the cables. Colcrete is a grout made from sand, cement and water mixed in a colloid mill. The mill makes an intimate mixture of the three ingredients which resembles whipped cream. This is forced into the wire channels under a pressure of about 2 psi.

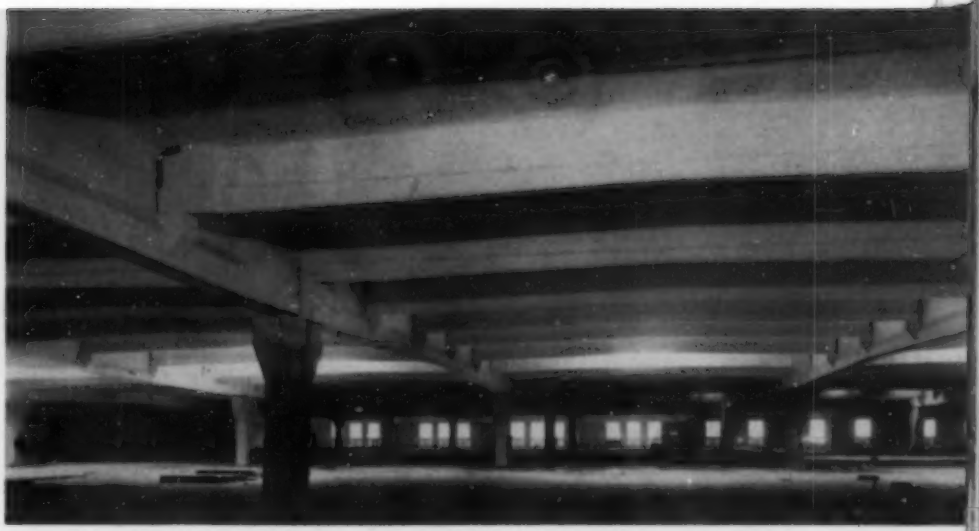
Sclayn Bridge Over Meuse River

What is probably the largest prestressed bridge in the world today is under construction at Sclayn over the Meuse River near Namur. (See photograph at head of article and Fig. 1.) The two abutments and a pier in the center of the river were all that the war left of the former bridge. The Department of Public Works of Belgium advertised for a new superstructure to be built consisting of two steel truss bridges each having a span of about 210 ft, but alternative bids were permitted on either reinforced concrete or prestressed concrete. Bidders were also permitted to provide additional piers but it was indicated that these were undesirable and might affect the award.

Twenty-three bids were received, all steel bids being high and all concrete bids low. The lowest bid was for a reinforced concrete bridge with five piers and the second lowest bid, which was accepted, was for a two-span prestressed continuous box-girder bridge requiring only the existing pier and abutments. The five piers required for the reinforced concrete design were considered too serious a handicap to river traffic.

In this bridge prestressing is obtained by straight wire units 420 ft long, each wire being 0.276 in. in diameter. The cables are placed inside the box-girders and are thus concealed but accessible. The cross section consists of three box-girders each 7 ft 6 in. wide, the partition walls being about 10 in. thick. The two outside boxes each contain 13 cables of 56 wires each, and the center box 10 cables of 48 wires each.

The compressive stress in the concrete does not exceed 2,160 psi. Any tensile stress in the concrete greater than 110 psi is taken up by ordinary reinforcing steel. Each outside face of the box girder is provided with wire-mesh reinforcement. The pier-support of the continuous girder is fixed by a hinge of the Freyssinet type, the expansion being from the center toward the abutments. All centering was made of steel pipe similar to the building scaffolding used in this country.



PRESTRESSED beams and columns form one-story textile mill covering 8½ acres in Ghent, Belgium. Structure was erected in one year by maximum of 70 workmen. Columns are spaced 72 ft in one direction and 47 ft in other. Steel forms were used to cast, on the ground, 100 identical girders and 600 identical beams. After prestressing, members were raised into position. Consulting engineer was Professor Magnel; contractor, Enterprises Blaton-Aubert, Brussels.

Taken in conjunction with its beautiful surroundings, this bridge when finished is certain to be referred to by bridge engineers as one of the most graceful structures in the world.

French Method—Freyssinet System

The Freyssinet system differs from the Magnel-Blaton system essentially in the fact that Eugene Freyssinet's cables are prefabricated and consist of 8 to 18 wires each, all wires being prestressed at one time. The wire units themselves are of the same size and characteristics as those described above for the Magnel-Blaton system; hence the prestressing force and the jack that exerts it must be many times larger, since Professor Magnel prestresses but two wires at a time. The wires are surrounded by a thin sheet-metal sheath in which they are held in position by means of a helical spring and spacers which keep all wires from touching each other during prestressing and at the same time permit the grout (which is forced in after prestressing) to encompass the wires completely. It was observed that the handling and setting of one of these cable units consisting of 12 wires was a simple process, not as difficult as the setting of a reinforcing rod of the same dimensions.

After the prestressing load is applied to the wires, they are locked in the prestressed position by a device known as a Freyssinet cone, which consists of two parts, a conical wedge and a hollow conical container. Each part is made of rich mortar formed in a mold and reinforced by steel hoops. When the wires have been stretched to their prestressed condition, the cone is forced into the container by means of a ram on the end of the jack. The wires, which lie between the two parts, are securely gripped by the wedging action of the cone into the conical shaped hole. The conical surfaces must be true to prevent any wire from slipping, and thereby reducing the carrying capacity of the cable. Slippage of wires can be observed without difficulty, and the usual procedure in such cases is to loosen the cable completely and repeat the prestressing operation until all wires are properly anchored. When the grouting of the wires has been completed, the wedges become redundant since the stress in the wires is transferred into the concrete by bond rather than by compression through the end blocks.

In 1946 a bridge designed by E. Freyssinet was completed across the Marne at Luzancy, France, with a span of 183 ft and a crown depth of 4 ft, giving a depth-to-span ratio of 1:45. This structure, while having the appearance of a girder bridge, is in reality a very flat two-hinged arch. The success of the design led to its adoption for five identical bridges at Esbly, Annet, Trilbardou, Ussy and Changis St. Jean. All these bridges were destroyed during the war. They varied in length from 250 to 260 ft, but by reducing all the span lengths to 243 ft it was found possible to make the new bridges exactly alike, and to prefabricate the members in a factory at a considerable saving in cost. This factory is located on the Marne River at Esbly, whence all parts were barged to the various sites.

Abutments Rebuilt to Resist Thrust

The abutments adopted had to be rebuilt not only to suit the standard span length but also to strengthen them against the thrust of the arch. This was done by transmitting a part of the arch thrust through struts to auxiliary abutments built behind the existing abutments. In some cases two of these auxiliary abutments were required to reduce the unit pressure against the soil to that of the original bridge.

Each bridge consists of six ribs spaced about 7 in. apart and connected transversely by occasional cross beams, all pulled together transversely after the 7-in. separators were poured, to make a 26-ft roadway. Each rib consists of 32 voussoirs and two open triangular end units. Two voussoirs in each rib are identical, making 12 similar pieces in each bridge. For the 5 bridges currently under construction, 60 identical pieces can be made from each mold. The molds are precision made and all abutting faces of blocks are true. No keys or dowels are used in the joints between the voussoirs, the resistance to sliding depending entirely upon friction developed between the surfaces by the force of prestressing.

Besides being prestressed longitudinally, the web of each voussoir is prestressed vertically by first casting the top and bottom flanges with the end loops of high tensile steel stirrups embedded therein. After the flange concrete has been steam-cured and set, the flanges are jacked apart to the proper girder depth and the web concrete is poured. When the web concrete has hardened, the jacks are

ESBLY BRIDGE (above) is one of five identical prestressed concrete arch structures erected over Marne River, France, by Freyssinet method. Each of six ribs consists of 32 precast voussoirs, erected and prestressed without falsework. Existing abutments were redesigned to fit identical spans. Hinge section and abutment for bridge at Annet are shown at right. Contractor is Enterprises Campenon-Bernard.

removed and the web concrete permitted to take the prestressing force, which completely eliminates the principal tensile stress.

It takes about 6 hours to complete the manufacture of a voussoir and upon completion it is removed to the storage yard and placed in its proper relation with adjacent segments, over supports set to the shape of the intrados of the arch. A compressive strength of 8,000 psi in 90 days is the miminum requirement.

To aid in shipping and erection, the ribs are divided into six sections tied together by temporary prestressing wires, which are cut loose after the permanent prestressing force has been applied. These sections consist of the end triangle plus the first voussoir, 5 voussoirs for the haunch, and 10 voussoirs for the two center sections. The assembled sections weigh between 2 and 4 tons each. By a method of tiebacks the entire arch section can be erected without the use of centering and without interference with traffic on the river. (See Fig. 2.)

The arch ribs are I-sections, 2 ft 10 in. deep at the center and 7 ft 10 in. deep at the haunches, with a ratio of span to depth of 45:1. The maximum depth at the support is 144 ft 7 in. The profile of the road shows a rise in elevation between the abutment and the center—a distance of 123 ft—of 2 ft 9 in. The terminal triangle of each truss is supported through a Freyssinet articulation system and flat Freyssinet jacks, which transmit the stress into the abutments and compensate for any variation in length due to plastic flow of the concrete or movement of the abutments.

After the sections are in place, the final prestressing cables are placed. Bending moments are small in the center of the span and large near its ends. Cables are either threaded through tubes placed at the time of manufacture or laid in grooves which are afterward concreted over. The prestressing cables in the central part of the span are in the lower flange. Over the rest of the arch the cables in the upper flange are curved down through the tie of the open springing triangle to anchors just below the articulation. All cables are anchored in Freyssinet anchorage cones buried in the flanges at the time of concreting.

The effect of prestressing was very evident at the site of construction visited. Ribs laid side by side could be seen in the various stages of prestressing. Those ribs which had been prestressed were lower by inches at the crown than those which had not. The whole bridge is prestressed transversely after the longitudinal prestressing is finished and the separator strips have been poured.

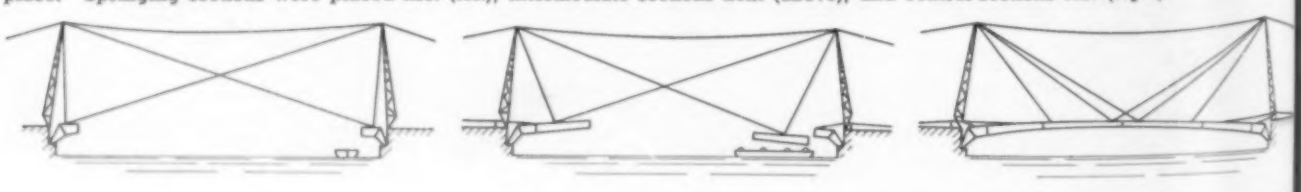
The beauty of these bridges is apparent from the simplicity of their lines. The design is strictly functional, amazingly slender and efficient. The designers are to be commended for their courage and confidence in their computations since there was no precedent even approaching such proportions. These bridges are being built by Enterprises Campenon-Bernard.

Swedish Method—Hoyer System

The prestressed concrete industry in Sweden has progressed rapidly; in fact between 1943 and 1947 more than 500 buildings were erected using prestressed roof beams and other units. Indications are that this average has been maintained since.

At the Bjuggren factory of the Betongindustri in Stockholm, all prestressing is done by the system of E. Hoyer using $^{5}/_{64}$-in. wires having a tensile strength of 280,000 to 340,000 psi.

FIG. 2. DIAGRAMS illustrate erection sequence for five identical prestressed arch bridges of 243-ft span over Marne River, France, designed by Eugene Freyssinet. Ribs were precast in central yard, barged to site, hoisted into position by cables, and prestressed in place. Springing sections were placed first (left), intermediate sections next (above), and central sections last (right).



STOCKHOLM FACTORY of Betrongindustri fabricates many types of prestressed concrete members by Hoyer system. Tension applied to very fine wires in forms before concrete is placed, is transferred to concrete by bond only, so that completed members can be sawed to any length desired. Various shapes and sizes of piles, posts, poles, slabs, columns and roof beams (up to 75-ft span) are stocked.

The applied stress is usually 180,000 psi, which is higher by 50,000 psi than that used in Belgium and France, where the wires are larger. This stretching force is released after the concrete has hardened and is transferred through bond into the concrete. The ratio of surface area to cross-sectional area is so high that no special end anchorages are required. This permits sawing of the products to the required length, which makes it possible to accumulate a backlog of units at the factory since they can be cut to length as required.

At the factory in Stockholm, beams have been built with only the lower flange of prestressed concrete, the upper part of the beam—which takes compression only—being cast after the prestress in the wires has been released. These beams are more efficient as there is no compression placed by prestressing in that part of the cross section of the beam which is required to take compression from the live loads. This is a refinement which has not been adopted universally.

When visited, the storeyard at the plant was filled with a multiplicity of products such as piles, lamp posts, fence posts, poles, floor slabs, all sizes of roof beams and columns. Even prestressed concrete bathtubs are made here.

The methods developed in Sweden have reduced building construction to the simplicity of a child's erector set. Several types of roof beams are made, depending on the span length. For spans up to 45 ft, the beams have a rectangular cross section but for those of greater length an I-section is commonly used. Both types of beams can be furnished with a slope for roof drainage, which has been standardized at $^{1}/_{16}$ in. per foot. Roof beams have been made up to 75 ft in length.

Prestressed concrete roof slabs are also manufactured here. Because the concrete is always in compression, the slabs are watertight and need no roofing material. The joints are filled with cement mortar and sealed with asphalt. To prevent local deflection of the slabs due to point loads, a joint bolt with large washers is put through the joint every few feet so that both adjacent slabs will be forced to deflect together. Longer bolts can be used to support a suspended ceiling, if one is required, in which case the one bolt is made to serve a double purpose.

Poles for overhead lines for railways, street cars and trolley buses and for overhead cables and lighting, are now in extensive use. They have many advantages over other types of poles, including great strength and resistance to corrosion. They are made solid and hollow, square, round, octagonal, cross- and I-shaped to suit the case at hand. For very high poles, a frame truss construction is used. The amount of steel used in a prestressed pole is only 10 percent of that for a steel pole of similar strength, so that if steel is in short supply the advantage of the prestressed design is obvious. Another advantage over the steel pole is the freedom from maintenance, no painting being required. Precast concrete poles are easily fitted with brackets, holes, and special climbers and may be set in normal ground with stones, it being unnecessary to provide costly cast-in-place foundations.

Precast prestressed fence posts are used extensively in Europe in connection with woven wire fencing, which is fitted to the posts. These fence posts are permanent and maintenance free.

Another use for the lighter prestressed units is in the construction of bunkers or bins for the storage of coal, coke, sand, and stone. These bunkers are made of prestressed concrete columns and slabs with the slabs running horizontally between the columns and held to them either by bolts or by grooves. Bins of this material are permanent, fireproof and require no maintenance. Therefore they are more economical over a long period of time.

Precast prestressed piles are 8 in. × 8 in. × 75 ft in length. The Betrongindustri reports that no breakage occurs in handling and driving. The allowable load on one of these prestressed Swedish piles is 25 tons, which compares with that allowed by the specifications of the AASHO for a 10 × 10-in. reinforced concrete pile under favorable conditions. Yet the Swedish pile contains only about one-quarter the amount of steel used in the reinforced-concrete design. These precast prestressed piles are in such demand that the company keeps a stock pile constantly on hand and cuts them to length to suit individual requirements.

English Method—Hoyer System

In England we visited the new plant being built at Iver, Buckinghamshire, by the Concrete Development Co. Ltd. This plant when completed will be similar to the Bjuggren plant at Stockholm both in appearance and in products produced. The Iver plant has a modern and complete concrete-mixing plant located in the building itself. The mixer discharges directly into the conveyors feeding the molds. Cement is stored in bulk in silos capable of holding 60 tons, and each of the five bins at the batch mixer can hold 5 tons of cement and 15 tons of aggregate. The concrete made here is cured by steam and the forms are removed after 14 hours. The wires are flame cut after the concrete has hardened sufficiently to take the prestress compression.

Adjacent to the Iver Plant is a laboratory with a pilot plant and testing apparatus so that project designs can be prepared and tested without interference with the output of the main plant.

English Stent System

The Stent Company plant at Dagenham Dock, London, has had years of experience in manufacturing precast prestressed units. It is the only plant visited which uses large wires (0.2-in. diameter) for prestressing small units. Here railroad ties

(*Continued on page 92*)

Careened Drydock Passes Through Panama Canal Locks

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TRANSFER of floating drydocks from one operating site to another during the war sometimes involved passage through the Panama Canal, a difficult problem for certain types of these drydocks because their width was greater than the lock width of 110 ft. These floating drydocks had been developed in the early stages of the war to meet an urgent need at advanced bases for docks of medium capacity. An existing design was adapted to quickly provide docks capable of being towed across the oceans, and several such docks were constructed on each coast.

The docks here discussed, called self-docking, consist of three sections, a center section and two shorter end sections whose sidewalls are shaped to fit into the overhanging sidewalls of the center section. Dimensions vary depending on lifting capacity, but generally the length of the center section is about 376 ft plus an additional 56 ft at each end for the overhanging walls. Each end section is about 87 ft long. The width of all sections is 116 ft. The sections are so dimensioned for self-docking reasons, that is, so that the end sections can lift the center section and can be drydocked in the center section.

When it was necessary to transfer some of these docks from one operating site to another, the most difficult problem encountered was that of transiting the Panama Canal. The 87-ft-long end sections could easily be towed through sideways independently of the center section. The center sections however, were another problem.

After intensive study of numerous schemes, including cutting the docks in various ways, it was decided to careen the center sections 90 deg so as to float them on their side—considered to be the simplest and cheapest method.

In the careening operation, three main objectives had to be considered: (1) By one means or another, the center section had to be rotated 90 deg until it floated on its side; (2) sufficient stability had to be provided to prevent the section from flopping over at any stage of the careening operation; and (3) stresses in all parts of the structure had to be maintained within safe limits. The first

THREE SECTIONS MAKE UP 15,000-ton-capacity sectional self-docking drydock when in operation. Length of center section is 376 ft and end sections, which fit under overhanging end walls of center section, are each 87 ft long. Sections are 116 ft in width. Panama Canal lock dimensions of 110×1,000 ft permitted end sections to be towed through sidewise, but posed problem for transit of center section.

and third objectives were a fairly simple matter of adding weights and reinforcing members, but were dependent on the solution of the second objective, which was a major problem requiring much computation.

It was apparent that stability in the 90-deg position was not possible with the drydock dimensions as they were and that the simplest way to obtain such stability was to increase the width of the sidewall to be immersed. The 110-ft width of the Canal locks would permit the extension of this immersed wall approximately 35 ft with sufficient clearance remaining. After a consideration of various ballast materials, the standard Navy pontoon boxes used so extensively during the war, were chosen as best suiting the requirements. These boxes are so built that each can be filled with water or emptied by the mere attachment thereto of a hose from headers and the operation of a valve by hand at each hose location. The connection of the pontoons to the dock structures presented no difficulty.

Stability in 90-Deg Position Checked

While the addition of the pontoon gear would afford relative stability in the 90-deg position, investigations had to be made to determine whether damage to or loss of the dock might occur if adverse conditions were encountered.

The first danger considered was wind. It was feared that the extensive exposed area might afford a sufficiently large wind moment to rotate the dock enough to cause it to capsize. Investigations showed, however, that the dock in the 90-deg position could resist wind forces greater than any to be expected in the Panama Canal area. In fact there was sufficient resistance to withstand, without capsizing, winds of hurricane intensity, acting normal to the entire exposed area —an unlikely combination.

Damage to and subsequent flooding of the various submerged portions of the dock was also considered. Flooding of a dock ballast compartment would have the effect of partially righting the dock. Since the dock is divided into four compartments longitudinally, tipping could be prevented by flooding the corresponding compartment on the opposite side of the longitudinal center line. If the area above the safety deck were to become flooded, the dock would list past 90 deg, but not sufficiently to cause capsizing. The dock could be returned to the 90-deg position by removing some of the ballast from the pontoons. The last consideration was the possibility of damage to the pontoon boxes. As there were almost 1,000 individual boxes, most of them full of water, it would be unlikely that enough of the remaining empty boxes could be flooded to endanger the stability of the dock. Assuming such a condition possible, the dock could be partially righted by flooding the dock's ballast compartment.

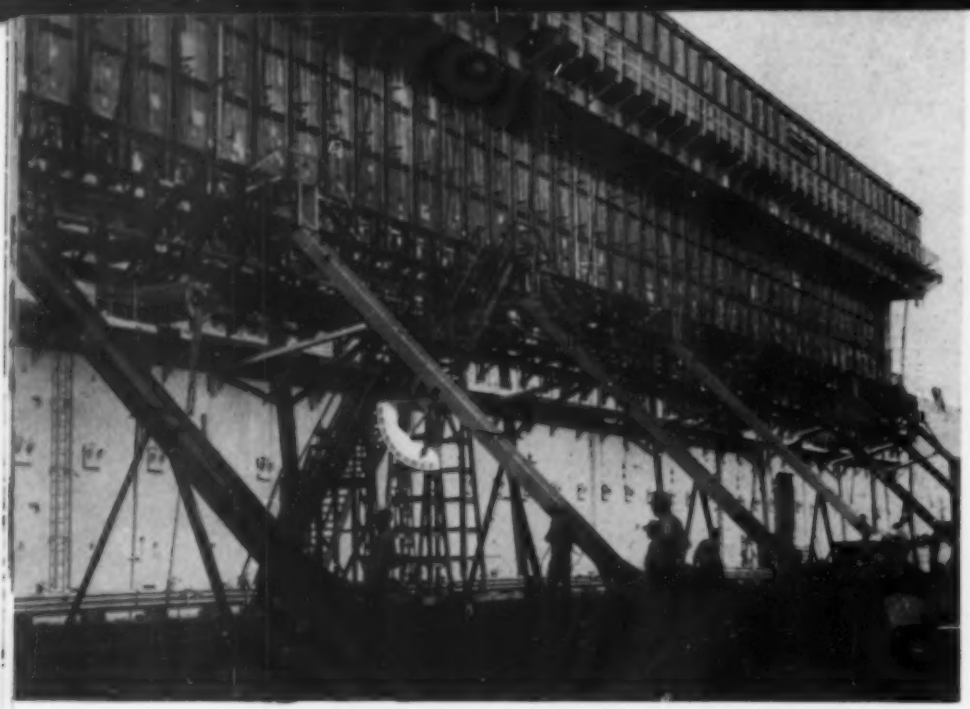
A consideration of all these eventualities indicated that the careened dock section would be virtually unsinkable.

CAREENED AT ANGLE of 90 deg, center section of drydock is towed through lock of Panama Canal. Stability of dock in this position was secured by adding 35 ft to width of immersed sidewall by using 960 standard Navy pontoon boxes. Also, sidewall was reinforced and made watertight and diagonal struts and braces were added.

Stability During Careening Operation Studied

With the addition of the pontoon boxes on the top of one sidewall the problem was, however, not completely solved. While the section could be careened 90 deg to a stable position by adding water to the pontoon boxes, it would not be stable throughout the operation. During the rotating process the stability or metacentric height would gradually drop to zero, at which point the dock would continue to careen without the addition of more ballast until it again reached a position of stability. Instability might continue from a 25-deg to a 65-deg position, or even over a greater range, and was undesirable for several reasons. First, it was advisable to have positive control of the section at every point in the careening process. In the event of damage, sudden strong winds, or other reasons, it would be best if the operation could be stopped, reversed, or slowed down at any point. Furthermore, it was possible that sufficient momentum might be developed to carry the dock past the 90-deg angle and capsize it. Also, the rapid careening motion followed by a sudden stop would cause exceedingly large impact stresses in the dock. For these reasons, it was decided to maintain a positive metacentric height throughout the careening operation.

Since the minimum metacentric height would occur at the 45-deg position, if the height could be made positive at this position, the dock would be under control in all positions. It was decided that the problem could be solved by having the dock section sink deeper into the water, making the distance between the center of gravity and the center of buoyancy smaller, and the surface-water plane cut by the dock section larger, both



READY FOR CAREENING, center section of drydock carries about 960 Navy pontoon boxes equipped with hand-operated valves and rubber hose. Air and water headers are on dock wall below boxes. Reinforcing struts are in place. List indicator, near center, permits accurate determination of degree of list during careening operation.

of which changes would give greater stability. This aim could be accomplished very simply by adding water to the dock-section ballast compartments. Only enough water would be added in these compartments to give positive stability at 45 deg, the point of least stability. Then the dock ballast compartments would have to be pumped dry before the 90-deg position was reached, because in this position the ballast water would reduce the freeboard and decrease the metacentric height.

Steps in Careening Process

The procedure for carrying out the careening procedure was not as simple as it might appear to be. Obviously the amount of water required in the pontoon boxes for careening, as well as the amount of water in the dock-section ballast compartments required for stability at 45 deg, would depend on the weight and location of the center of gravity of the dock section. Unfortunately, because of the many alterations and additions to the dock section since its initial construction, these figures were not known. Accordingly a procedure had to be worked out to cover a wide range of values of weights and locations of centers of gravity. A series of charts, with detailed instructions, was prepared to determine, in the first part of the careening operation, the section weight and location of the center of gravity, and thus to determine the exact amount of ballast required both in dock ballast compartments and in pontoon boxes for the remaining part of the careening operation.

In preparing for careening, about 960 pontoon boxes in stacks of 15 boxes each were added to one of the sidewalls; all movable equipment and supplies were removed or braced; the sidewall to be immersed was reinforced and made watertight; and diagonal struts and braces were added to reinforce the submerged sidewall. Gages were installed to show the draft, from which were determined the displacement, amount of contained water, and angle of list.

The first step in careening was to add water to the dock ballast compartments on the side toward which the dock was to be tipped. Flooding was accomplished by opening the dock flooding valves. This was the ballast required to give stability at the 45-deg position. Since the exact quantity of water required could not be computed until the location of the center of gravity was known, the quantity of water added at this point was merely a rough approximation. By means of the various gages and charts, the total displacement and amount of contained water was computed. This operation caused the dock to list about 8 deg.

The next step was to fill several of the 15 rows of pontoon boxes running the length of the dock. These boxes were connected by hoses to a single header and the necessary pumps were located on a barge at one end of the dock. Flexible hose connected the pumps on the barge with the header on the dock. Filling three rows (64 boxes in a row) caused the dock to rotate about 18 deg. These angles would of course vary on other dock sections, depending on the dock weight, amount of contained water in the dock compartments and center of gravity of the dock. Since all pertinent values except the dock's center of gravity were known at this point, the careening charts were used to determine the center of gravity. This procedure was nothing more than the standard inclined test on a ship when launched.

Once the section weight and center of gravity were known, the amount of contained water required for stability at 45 deg was determined from a chart. At this point water could have been added to or removed from the ballast compartments but such a change was not necessary as the initial estimated amount was within a reasonable allowable tolerance of the amount determined by the chart. The lead-off photograph shows the dock in a partially careened position. The barge in the foreground supplies power for pumping and houses the pumps used.

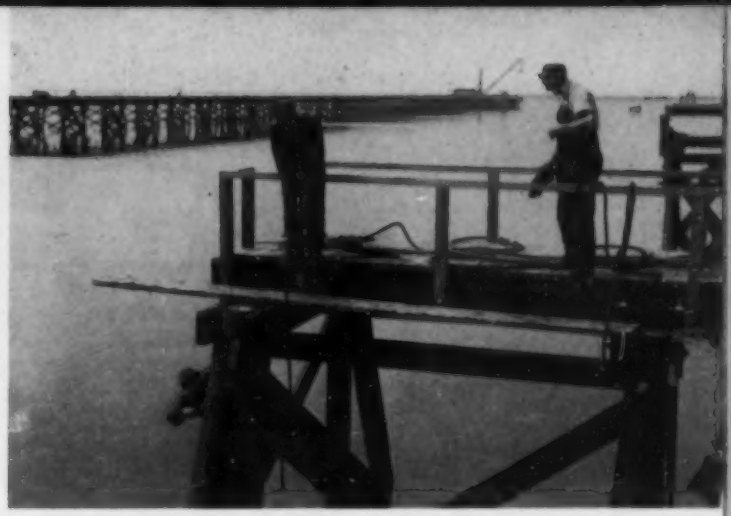
Next, water was added to the pontoon boxes until the dock careened to about 65 deg. Then water was pumped from the dock ballast compartments to careen the dock to about 87 deg. As the final step in the careening process, water was added to the pontoon boxes to list the dock to 90 deg, in which position the dock section was towed through the canal.

Careening Process Reversed for Righting

The righting process was essentially the reverse of the careening process. First, the dock was rotated back to about 68 deg by flooding the dock ballast compartments. Next it was further righted by emptying the pontoon boxes. This process was hastened by blowing the boxes out with compressed air. This was accomplished similarly to the flooding process, by hose connections from a single header. The pump and power barge also contained the air compressors which were connected by flexible hose to the header on the dock. Finally the water in the dock ballast compartments was removed by the portable pumps. The pontoon gear was then removed and the dock restored to operating condition.

The successful completion of careening and transiting of these docks through the Panama Canal is a tribute to all concerned. The project was accomplished by the Bureau of Yards and Docks, Navy Department, with Frederic R. Harris, Inc., serving as consultant on the engineering features, and with the Navy SeaBees and Panama Canal authorities executing the work.

FLOATING CRANE with special frame attached (left) places and drives both vertical and batter piles at one setting for approach-light piers at New York's International Airport.



Approach-Light Piers Mark Glide Path at Idlewild Airport

THE GLIDE PATH of aircraft approaching New York's International Airport is marked by the intersection of sealed-beam lights mounted on two diverging piers. These piers, extending 2,040 ft into Jamaica Bay from near the end of the runway at New York's Idlewild Airport, indicate the approach to the 1.6-mile north-south runway. The lights are set at a constant vertical angle and evenly spaced along the piers, each of which diverge from the center line of the runway at an angle of $2^1/_2$ deg. The intersections of the light beams are calculated to fall along the glide path of aircraft approaching from the south.

All-wood piers are supported by 75-ft wooden piles, which are designed to carry 15 tons each. The piles were driven with a McKiernan-Terry 9B2 hammer, and held by a special frame which sets three piles at the same time—two of them on a batter. All pile driving was completed as the driving rig moved forward.

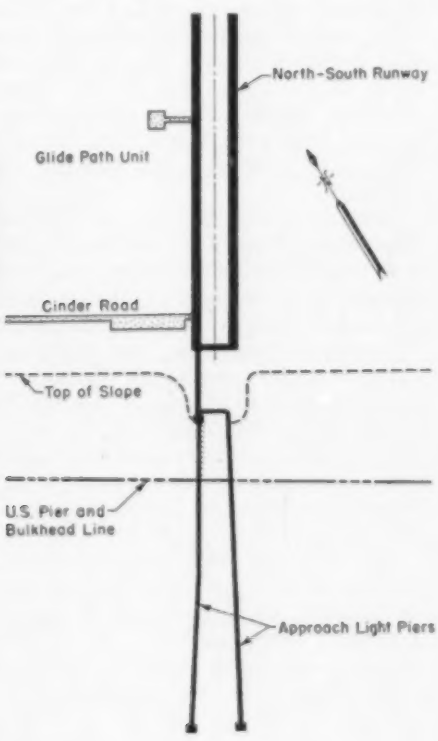
Original plans called for a single pier to carry the lights, but it was found more expedient to use the two-pier system. When the change was made, the first pier had already been constructed several hundred feet out into the bay. Construction of the pier was continued at an angle of $2^1/_2$ deg from the original direction. Extensions were then added to the section already erected so that lights on the ends of the extension fall along the $2^1/_2$-deg line (Fig. 1). The piles were driven 25 ft into the silty sand found along the bottom of the bay at this location. At the construction site the water is about 30 ft deep.

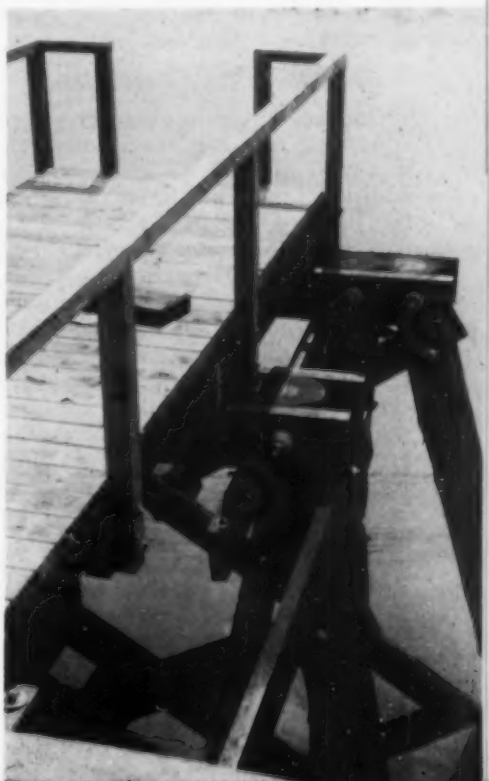
The piers were built for the Port of New York Authority by the Frederick Snare Corp. Carillo & Greene, Associates, designed and inspected construction for John M. Kyle, the Port Authority's Chief Engineer. David Bonner, M. ASCE, was project manager for Frederick Snare; Arthur Henricksen, Assoc. M. ASCE, job manager; and Joe Corfield, Superintendent on the job.

ADDITIONAL CROSSBRACING IS PLACED on light-supporting extensions. Lights will be placed about every 100 ft along piers and extensions. Westinghouse All-Weather Approach-Light system permits burning brightnesses of 100, 1,000 or 10,000 candlepower or flash brightnesses of 100,000 or 10 million candlepower.

DECKING IS TREATED with fire retardant, but is not creosoted. Approach lights will be placed at open end of platform extending east for short distance from one of main piers. Figure 1 (left) shows 5-deg angle between piers. Middle marker out in bay—as its name implies—marks center line of north-south runway.

CREOSOTED TIMBER PILES and crossbracing form support for pier decks. Connections are bolted. View below was taken under deck at south end of east pier.





Air-Entrainment Decreases Scaling on Ohio's Highway Pavements

R. R. LITEHISER, M. ASCE, and J. F. BARBEE, Assoc. M. ASCE

Respectively, Chief Engineer, and Engineer, Testing and Research Laboratory, Ohio State Department of Highways, Columbus, Ohio

OHIO'S FIRST HIGHWAY pavement built entirely of air-entraining concrete, was constructed in 1942. Although specifications have undergone changes, the state's Highway Department has continued its program of constructing pavements of air-entraining concrete until it now has 400 lane miles of this type of concrete. Cooperating with the Portland Cement Association, the Depar ment has made detailed inspection of its pavements and rated them according to the amount of scaling found. Results seem to be uniformly better with the use of air-entraining concrete. By the addition of a small amount of neutralized Vinsol resin, many minute disconnected air bubbles are formed and the durability of the concrete is increased. Adding the air-entraining agent at the cement mill is preferred for Ohio highways. Tests indicate that the percentage of air-entrainment attained in 1947 averaged between 2.2 and 5.4, as compared with the specification of between 3 and 6 percent. The authors believe that still greater durability can be achieved if the amount of air entrained can be kept within the upper two-thirds of the specified range.

IN AN EFFORT to obtain concrete pavements having better resistance to salts for snow and ice removal and to freezing and thawing, the Ohio State Highway Department turned to air-entraining concrete in 1942. Two years previously an experimental project had been constructed to study the characteristics of this comparatively new type of concrete. (See *Proceedings* of the Twenty-Second Annual Meeting of the Highway Research Board.) Satisfactory performance in this instance, together with reports of similar experiences by others, convinced the Department that air-entraining concrete merited favorable consideration for future pavement construction.

Addition of Vinsol Resin Specified

One air-entraining concrete project consisting of about seven lane miles was built in 1942. Each year since, additional projects have been built by January 1, 1949, the total air-entraining concrete pavement built in Ohio by the Department exceeded 400 lane miles. Since construction of the first project, Ohio specifications for air-entraining concrete have undergone several changes. Specifications for the first four projects required that the portland cement be ground with an amount of Vinsol resin which would cause a reduction in the unit weight of the concrete of 4 to 8 lb per cu ft.

Early in 1943 change orders were issued by the Highway Department requiring that portland cement containing Vinsol resin be used on all projects then under contract, providing they were not virtually completed. The order further provided that if cement containing Vinsol resin was not furnished, the contractor should add sufficient neutralized Vinsol resin at the mixer to cause a reduction in the unit weight of the concrete of 3 to 5 lb per cu ft.

In August 1943 the minimum cement factor was increased from 6 to $6^1/_2$ sacks per cu yd and at the same time the maximum water-cement ratio was reduced from 6 to $5^1/_2$ gal per sack of cement. No doubt these changes made some contribution toward improved durability, though their effect would be difficult to evaluate.

The American Society for Testing Materials adopted the standard mortar test for air-entraining portland cement in 1944, and in March 1945 Ohio followed suit. The then-current requirement was that portland cement contain sufficient Vinsol resin (dry or neutralized) or Darex to cause the entrainment of 14 ± 4 percent air in standard mortar. The Ohio Department also retained the alternate admixture specification carried in the 1943 change order.

All contracts awarded since January 1, 1947, required that the concrete have an air content of 3 to 6 percent. Specifications for air-entraining portland cement required that Vinsol resin be neutralized when used as an interground air-entraining agent. Further, it was required that the cement entrain 16 ± 4 percent air in standard mortar.

Ohio has followed the lead of the ASTM in adopting the 18 ± 3 percent entrained air limit in its specification for air-entraining portland cement. The final control, however, is the 3 to 6 percent limit on air entrained in the concrete. These changing specifications show that there has been a transition period of successive revisions in air-entraining concrete. As will be seen from the data here presented, these revisions have resulted in progressive improvement in the durability of concrete pavements in Ohio.

Inspections Showed Value of Air-Entraining Concrete

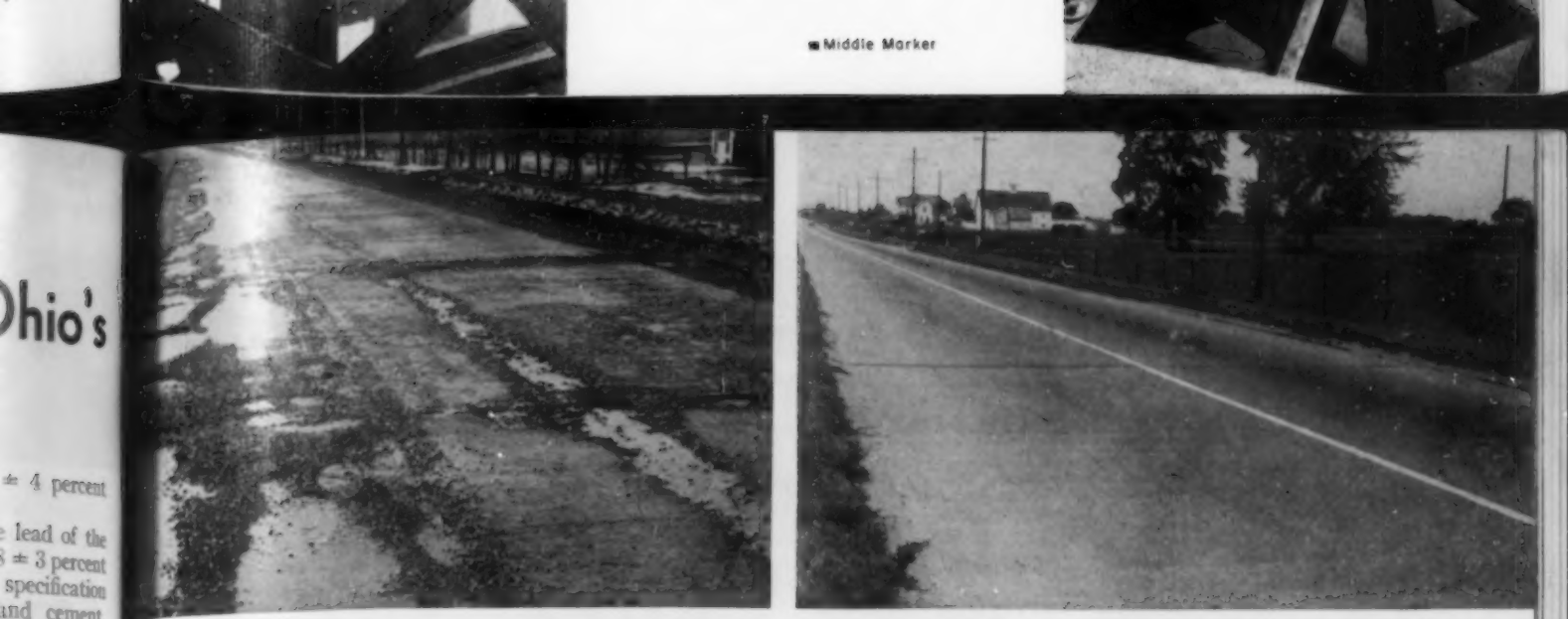
In 1945 and again in 1948 the Ohio Highway Department and the Portland Cement Association made cooperative inspections of the surface condition of all air-entraining concrete paving projects constructed by the Highway Department. In order to rate the various projects as to extent of scaling, observed scaling was recorded and scale ratings were computed as follows:

$$\text{Scale rating} = \frac{(A + 3B + 5C)\,100}{5S}$$

in which

A = number of slabs scaled less than 10 percent of their area
B = number of slabs scaled 10 percent but less than 50 percent of their area
C = number of slabs scaled 50 percent of their area or more
S = total number of slabs

Out of 59 projects, 35 had scaled to some extent when inspected in 1945. However, a study of the scale ratings for these 35 projects reveals that except in a few cases the scaling was not extensive (1945 scale rating for the 59 projects was 1.95). This becomes more evident when it is pointed out that if every slab in the entire lane mileage of a project showed scale on less than 10 percent of its area, the scale rating would be 20. Only two projects inspected in 1945 had scale ratings that exceeded this value. The most extensive scaling occurred on a project where emulsified carbon black had been added to the concrete.



FOUR-YEAR-OLD PAVEMENT of normal portland cement concrete (above, left) exhibits severe scaling while eight-year-old pavement of air-entraining concrete (above, right) is in good condition. Left view, taken in February 1945, shows section of U.S. 40, just west of Columbus, Ohio, placed in 1941, less than four years previously. Right view, taken in August 1948, when pavement was eight years old, shows test road about two miles east of section at left. Air-entraining concrete on test road contained estimated air content of 5 percent, with Vinsol resin as air-entraining agent. Concrete was vibrated when placed.

In view of the fact that air-entraining concrete was in its infancy prior to 1945, its performance on the first 59 projects built by the Ohio Highway Department is considered remarkable in contrast to the serious scaling that had occurred on other projects built without air-entrainment. Although air-content data are not available for projects constructed prior to 1947, it is now realized that in all probability an appreciable percentage of the concrete placed prior to 1945 contained less than 3 percent air.

Conclusions Drawn from 1945 and 1948 Inspections

From the data collected in the course of the 1945 and 1948 inspections, the following conclusions have been drawn:

1. For the same age, the scaling of pavements built during 1945, 1946, and 1947 was only about one-fifteenth as extensive as that of pavements built during 1942, 1943, and 1944. Difference in severeness of winter exposure, amount of ice removal agents used and increased cement factor may have contributed in some measure toward this outstanding improvement in pavement durability, but it seems more reasonable to believe that the increase in the amount of air entrained in concrete pavements built during 1945–1947 was the predominant factor.

2. On projects built in 1942, 1943, and 1944, the scaling observed in 1948 had increased to approximately double that observed in 1945. However, the scale rating of these projects in 1948 was only 3.1.

3. The durability of colored air-entraining concrete was somewhat below that of natural-color air-entraining concrete. It is possible that the coloring material used on these projects counteracted the air-entraining material to some extent. Special care will be taken in the future to insure that the required air content is obtained in colored concrete as well as in regular concrete.

4. Job additions of air-entraining agents were used on 13 Ohio projects during 1943 and 1944. During the first year it appears likely that insufficient agent was added at the mixer to result in the desired durability. Scaling on 1943 construction was about twice as extensive where job-added air-entraining agents were used as where air-entraining portland cement was used. Concrete pavements constructed in 1944, using either a job-added air-entraining agent or air-entraining portland cement, exhibited about the same scale resistance except for one job constructed with Type IA portland cement. It should be emphasized that no data are available on the air entrained in this concrete. It is believed that under present specifications, which require that a minimum of 3 percent air be entrained in the concrete, the method used to effect such entrainment is immaterial so far as the resulting durability is concerned.

Ohio Hook Gage Method for Determining Air Content of Fresh Concrete

Before 1947, field determination of the air content of fresh concrete was either lacking or too limited to be of significant value. Practical means for making reliable field determinations were not available at that time. Prior to the start of the 1947 construction season, the Ohio Department made air-measuring equipment available for all projects. This equipment was designed to utilize a modification of the so-called stirring method of measuring the air content of fresh concrete, which we named the Ohio Hook Gage method. It had been previously tested in both laboratory and field and appeared to offer promise of satisfactory results when used with reasonable care by trained personnel. Correlation of results obtained by the Ohio Hook Gage method with the pressure method appeared to be good.

Field Tests Show Amount of Air Entrained

During 1947, a total of 670 field tests for air content were made on 15 projects and a statistical analysis of the data secured was made. No attempt was made to eliminate or evaluate any of the variables which are known to influence air-entrainment in concrete. Variations in aggregate gradation and particle shape, cement characteristics, temperature of mixture during mixing, quantity of mixing water, and mixing time all influence the amount of air entrained in concrete. Further, the care exercised by inspectors in making air-content tests influences the accuracy of the determinations. For this reason less weight should be given probability values for individual projects than the values which consider the 670 tests made in 1947 as a single population.

The analysis of 1947 data shows that in 99 out of 100 tests for air content made by the Ohio method, the air content can be expected to fall between 2.2 and 5.4 per cent; and further, that in 11 out of 100 tests, the air content can be expected to fall below 3 percent. Thus the upper and lower limits of the probability range of 2.2 to 5.4 percent are both below the corresponding limits of the specified 3 to 6 percent. These results would indicate that generally the air-entraining capacity of the cement used in 1947 was not quite high enough to produce the desired air content values in the field, inasmuch as air-entraining cement was used in 99 percent of the concrete. It would also indicate that some scaling might result. Actually, a very small

(*Continued on page 92*)

Finland Meets Acute Power Shortage by Comprehensive Development of 68-Mile Rapids

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IN THE PEACE TREATY following World War II, Finland lost one-third of her developed waterpower. At the same time her power needs were greatly increased by the terms of the treaty, which called for the payment of a war indemnity primarily in industrial products. Other wartime difficulties added to the demand for hydroelectric power. As South Finland's waterpower was already utilized for industrial purposes, it was necessary to go north to find a means of meeting the power shortage. The result was a comprehensive plan for the development of the Oulujoki River and rapids by means of eight plans to utilize a total head of 387 ft. Two of these plants are now generating power, the third will be put in operation later in 1949, and construction of the fourth is getting under way.

WITH THE ACUTE NEED for increased hydroelectric power in Finland following the war, attention was focused on the Oulujoki River, which represents the major potential source in the hitherto undeveloped northern part of the country. This river flows from Lake Oulujärvi in west central Finland into the Gulf of Bothnia, a distance of 68 miles, in which the total fall is about 394 ft. The regulating effect of the large lake at the head of the river will be such that practically the entire annual water volume can be utilized. The lake will be used as a regulating reservoir. The average discharge is about 8,475 cfs.

Design of the hydroelectric plants was facilitated by the fact that the banks are generally high and steep so that the damage caused by damming is relatively small. The rapids in the river are long and gently sloping. Also, bedrock is fairly close to the bed of the stream, providing a solid foundation for structures. The present plan for the Oulujoki River incorporates the construction of eight dams and powerplants. Beginning at Lake Oulujärvi and proceeding downstream, these plants are: Jylhämä, Nuojua, Utakoski, Sotkakoski, Pälli, Pyhäkoski, Montankoski and Merikoski. (See Fig. 1.) Together the plants have a useful head of about 387 ft. Investigations are being conducted with the idea of combining Utakoski and Sotkakoski. All the plants will be operated as a group. Likewise it has been assumed that the large power plants and systems in Finland will be utilized toward common ends, to achieve the most economical results possible.

First Plant Started Under War Conditions

Four of the projects have already been launched—Merikoski, Pyhäkoski Jylhämä and Pälli—and the first two are in operation. Merikoski, the first to be undertaken, was built by the municipality of Oulu, and authorization for the commencement of work was obtained in the spring of 1939. However, World War II, which broke out in September 1939,

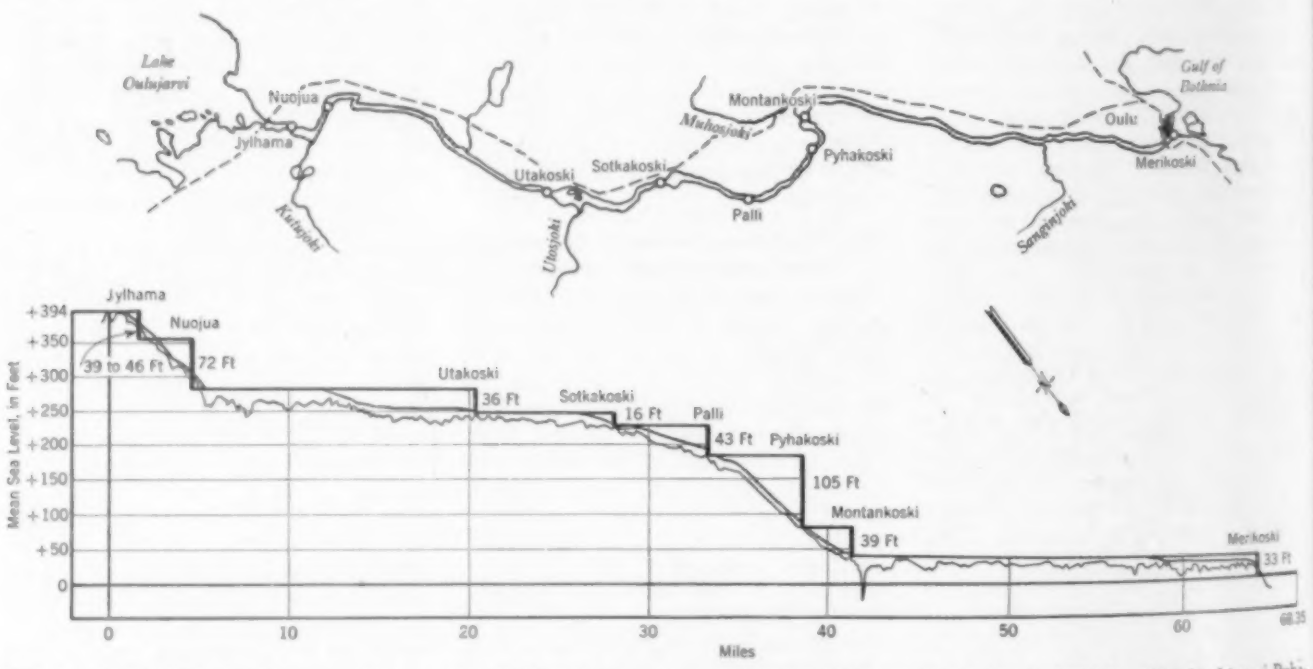
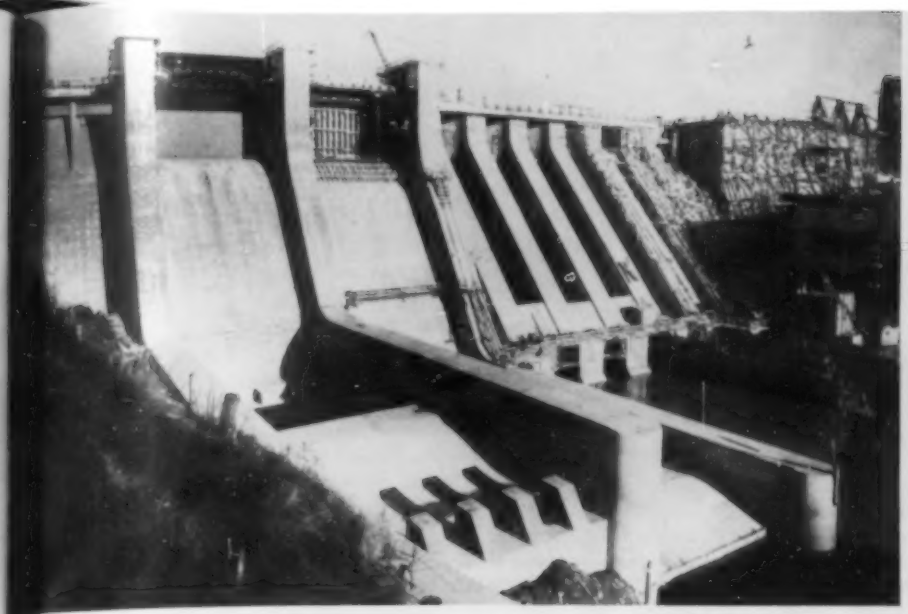
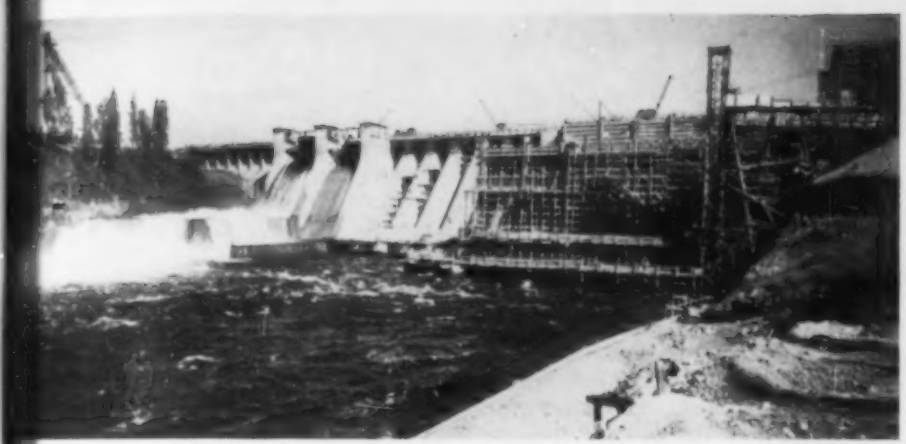


FIG. 1. PLAN FOR EIGHT power plants on Oulujoki River, Finland, would utilize 387 ft out of total head of 394 ft. Merikoski and Pyhakoski are completed; Jylhämä nears completion, and Pälli has been started. Investigations now under way look toward combination of Utakoski and Sotkakoski plants. Natural features are favorable as high, steep banks cause minimum damages from damming and bedrock close to river bottom provides good foundation for structures.





PYHAKOSKI DAM DEVELOPS highest head (105 ft) of plants on Oulujoki River. Downstream face of spillway nears completion in view above. Tooth sill below spillway (upper left, foreground) dissipates energy of overflow. Water was discharged through spillway (lower left) before powerhouse and south end of dam were completed. View of upstream face before water level was raised (below) shows six intake openings in left foreground.

prevented the start of construction. During the armistice in 1940, the so-called first stage of construction was completed, including the lateral dike and the main dam. The former is partly of earth and partly a gravity concrete structure. The main dam is closed by four radial gates. According to the plan, the plant when completed will contain three generators and will produce about 33,000 kw.

The conflict which broke out in 1941 almost completely stopped construction. Although the outlook was not very bright, the town of Oulu placed orders for generators and turbines for two units. The Kaplan turbines with vertical shafts, were ordered from the Finnish firm of Tampella, while the generators were ordered from the German firm of AEG, delivery to take place in two years. Work was carried on during the war but under very unfavorable circumstances so that it did not progress according to plan. The AEG reported that the first generator would be ready in 1944, but because of military developments, delivery was never made. Steps were then taken to procure one generator from the Swedish firm of ASEA, but currency difficulties delayed issuance of the import license until June 1945 and in the meantime ASEA had extended the time limit of the contract by one year as it could not meet the delivery date of August 1947. Thus delivery was postponed until 1948, when the first unit in the Merkoski powerhouse was finally installed.

The powerhouse is founded entirely on granite bedrock. The switchgear is on top of the draft tube. A fish elevator at the southern end of the building lifts salmon from tailwater to the intake channel. Also located at the southern end of the powerhouse is an intake tube for the station's service turbine, which is a horizontal Francis unit. The intake is controlled by radial gates, behind which the racks are situated. A log chute runs in tunnel through the north side of the building, and between it and the first unit there is a bypass for blocks of ice and runaway logs.

The intake channel of the plant is about 1,378 ft long and 230 ft wide, with a cross section of approximately 13,660 sq ft. The velocity of the water in the channel is about 2.8 ft per sec. On the northern side the channel is lined with stone riprap, but the southern wall is formed by a

LOWEST POWERHOUSE on Oulujoki River, near its mouth in Gulf of Bothnia, is Merikoski, which utilizes head of about 33 ft. Most of tailrace, in foreground, was blasted from rock. Powerhouse is connected with main river by intake channel 1,378 ft long. Log chute runs in tunnel though left end of building and next to it is bypass for blocks of ice and runaway logs. Fish ladder is also provided at right side of powerhouse.

concrete dam constructed of units 8 meters (26 ft 3 in.) in width, with the upper ridge acting as an overflow weir. There is a footbridge about 8 ft wide on top of the dam.

The tailrace, which for the most part was blasted from rock, has a length of about 1,804 ft and a bottom width of about 74 ft. About 235,450 cu yd of soil and 300,800 cu yd of rock were removed from the site. The concrete structures of the dam and powerhouse contain about 3,000 tons of steel reinforcing. The powerhouse was designed by the engineering firm "Consulting," and the contractor was O. Y. Vesirakentaja.

Pyhäkoski Plant Has Highest Head of Plants on River

All the plants on the Oulujoki River except Merikoski are owned by the firm of Oulujoki Oy, established in 1941. When the company was formed the state owned two-thirds of the shares and the remainder belonged to private industry. Since that time the major part of the Oulujoki River has come under a single ownership, making it possible to coordinate the work so as to secure the most economical utilization of the total head. The company's main purpose is the development of this river for hydroelectric power.

For its first project the company chose a location on the rapids where the highest head could be realized, that is, Pyhäkoski. The site was advantageous in that no lateral dikes were necessary for the powerhouse despite the fact that the water level was raised 105 ft, the head utilized for power generation. Likewise the tailrace is very short. Raising of the water level formed an artificial lake of 270 acres above the powerhouse. This lake can be used advantageously for daily regulation.

The powerhouse is situated on the southern bank of the river and has a maximum height of 200 ft and a volume of 196,200 cu yd. A public highway crosses the river along the dam. On the highway side of the powerhouse is the gate room containing machinery for hoisting the gates and racks and adjacent to this room are the 110-kv switchgear, transformers and station service equipment. Next comes the station hall with its generators. The design contemplates three units in the powerhouse, each consisting of a Kaplan turbine (manufactured by Tampella) and a direct connected generator. Each turbine is dimensioned for a water volume of about 4,700 cfs and a head of 105 ft. When all the units are installed, the output will be 108,000 kw, and the annual energy production, 560 million kwhr, which will make Pyhäkoski second in output of all the hydroelectric powerplants in Finland.

The first generator was ordered from the Swedish ASEA and has been delivered. The other two generators were ordered originally from the British firm of Metropolitan-Vickers but because of the long delay in delivery, the order was transferred to the International General Electric Co., Inc., of Schenectady, N.Y. The powerhouse equipment will be delivered by rail to the southern end of the building and thence transferred to the prepared foundations by means of rails and cranes. There is a 12-story administration building at the northern end of the powerhouse.

Immediately adjoining the powerhouse is the dam, which has a maximum height above bedrock of about 148 ft. The dam consists of seven dam units, two spillway openings, an overflow weir and a short lateral dike. The fishway, located close to the powerhouse, consists of a fishladder which continues into an elevator for lifting the fish into headwater. The lure water for the fish ladder is lifted from tailwater instead of headwater so as to save the energy difference. Next to the fishway is a bypass for blocks of ice and runaway logs.

There are eight bottom gates in the dam units, chiefly for the diversion of flow during construction. These openings can also be used subsequently for emptying the basin above the powerhouse. Spillway openings measure about 46 × 20 ft and are closed by radial gates. To prevent ice formation the piers are heated electrically. The tailrace has energy dissipators below the spillways.

There is still another opening in the dam—for the log chute. This flume has a length of 1,870 ft and consists partly of concrete and partly of sheet steel.

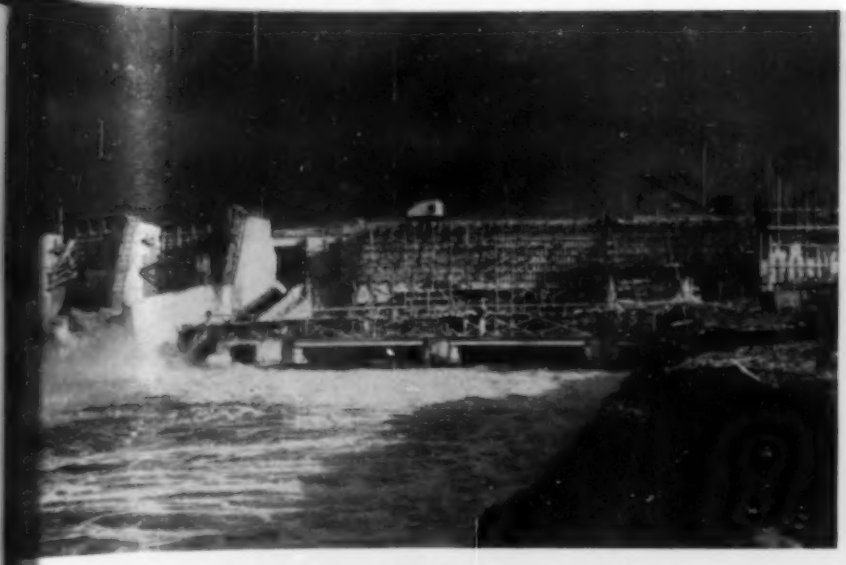
The 220-kw switchgear and transformers are situated in the switching yard on the south bank of the river, whence the 220-kv transmission lines carry the power to South Finland.

Operation Started in Spite of Many Difficulties

Work was greatly delayed by the lack of shovels and bulldozers. The total quantity of soil and rock removed from the site was 366,200 cu yd. Practically all the concrete needed for construction was produced in the batching plant at the site, which had a monthly output of about 6,540 cu yd. Filling stones have not been used in the concrete but the coarse aggregate has a maximum size of 4.7 in. About 143,900 cu yd of concrete has been placed, containing 33,000 tons of cement and 3,300 tons of steel reinforcing. Placing of concrete and reinforcing, and handling of wooden formwork were accomplished by a 5-ton cable crane. A complete laboratory was set up at the site for studying the quality of the concrete produced.

Preliminary work started at the Pyhäkoski site in 1941 proved to be a sizable and difficult job because of the isolated and uninhabited character of the region. The first step was to construct dwellings for the workmen and structures to accommodate offices, power station, warehouses, garages, sawmill, etc. Forty dwelling units and the necessary utility buildings were erected for the future staff.

On May 1, 1948, the water was raised to its ultimate level. The first generator arrived at the end of 1948 and was erected by March 1949, and on April 10 the prime minister of Finland officially opened the Pyhäkoski powerplant.



REGULATING WORKS FOR LAKE at head of river are incorporated in Jylhämä project. Topography required considerable excavation (1½ million cu yd) for 1½-mile-long channel between lake and powerhouse and for tailrace (almost one mile long). Tailrace, nearly completed, appears in top right-hand view. In upper left-hand view, powerhouse is under construction at right, while water passes through spillway openings at left. Isolated location required building of complete community, including housing for 1,400 workmen (above). Oulujoki River before start of work is seen at right.

The other two units still await the delivery and installation of generators from the United States.

Lake Regulating Works at Jylhämä

In 1946, Oulujoki Oy commenced work on its second major power installation—that at Jylhämä. Although Jylhämä is only fourth in size of the developments on the Oulujoki Rapids, its construction was started next because it incorporates the dam for the regulation of Lake Oulujärvi, to be used as the regulating reservoir for the plants along the river. In order to use the lake efficiently as a regulating basin it was necessary to construct a channel 1½ miles long between the Jylhämä powerhouse and the lake. Topography also required the construction of lateral dikes with a total length of about 2.2 miles. These are all earth dams for which the necessary material was taken from the channel and tailrace. The tailrace is 4,920 ft long, and from it and the channel together a total of more than 1½ million cu yd of rock and earth were removed.

A fork in the river made it possible to divert the flow into a parallel channel past the construction site, thus greatly facilitating quarrying and excavation operations in the permanent channel and tailrace. A public highway will run in front of the powerhouse and continue along the main dam and the earth dike to the north bank of the river.

In principle the design of the powerhouse at Jylhämä is identical with that of Pyhäkoski but because of the lower head, the switchgear is situated on top of the draft tube and the scroll flume is of reinforced concrete. Immediately to the north of the powerhouse space has been reserved for a fishway and fish elevator. There are two spillways, which will be closed by radial gates manufactured in Finland by Tampella. There is also a log chute, between the spillways and the fishway.

The power plant will consist of three units, the turbines being designed for a flow of 4,700 cfs and a head of 39 to 46 ft. When all the units are in operation the output will be 45,000 kw and the annual energy generated about 220 million kwhr. The three turbines have been ordered from the Finnish firm of Tampella and the generators from the Swiss concern of Oerlikon.

Like Pyhäkoski, the site of Jylhämä is in a very sparsely inhabited region, making it necessary when work was begun in 1946 to build a complete temporary community, with dwellings for 1,400 workmen, shops, a hospital, laundry, office building, garages, a smithy, repair shop, power station, foundry, batching plant, etc. Later an elementary school was established for the children of employees. When the plant at Jylhämä is completed it is expected that this community will be used as the base for construction of the plant at Nuojua, about 1.9 miles downstream.

At Jylhämä the tailrace, dam and lateral dikes have been completed. Work on the powerhouse has progressed to the point of setting up the turbine of the first unit. The first generator will arrive in September, so that the plant can be put in operation during the current year. The second unit will be set up after an interval of three months.

At Pälli, the third project on the Oulujoki to be undertaken by Oulujoki Oy, preparatory work was commenced in January 1949. Construction on the Nuojua project will start next winter.

A 220-kv transmission line was completed this year by Imatram Voima Oy, of which Oulujoki Oy is a subsidiary. This line connects the plants on the Oulujoki River with the power network of the rest of the country, making this new power source available to satisfy Finland's acute power need.

APPEARANCE WAS significant factor in choosing 100-ft concrete arch for City Creek Bridge on 14-mile State Highway to Big Bear Lake from San Bernardino, Calif. Engineering analyses and architectural studies are coordinated in Bridge Department.

Concrete Arch Carries Sharply Curved Highway Over 70-Ft Ravine

C. H. DARBY, Assoc. M. ASCE

Senior Bridge Engineer, California Division of Highways, Sacramento, Calif.

THE EAST FORK CITY CREEK crossing of State Highway 207 in San Bernardino County, California, provides the interesting and unusual spectacle of a concrete arch bridge on a 300-ft radius curve. The usual structure designed for such a site would be a rolled steel or concrete viaduct. However, after weighing costs and esthetic values, an arch bridge was chosen.

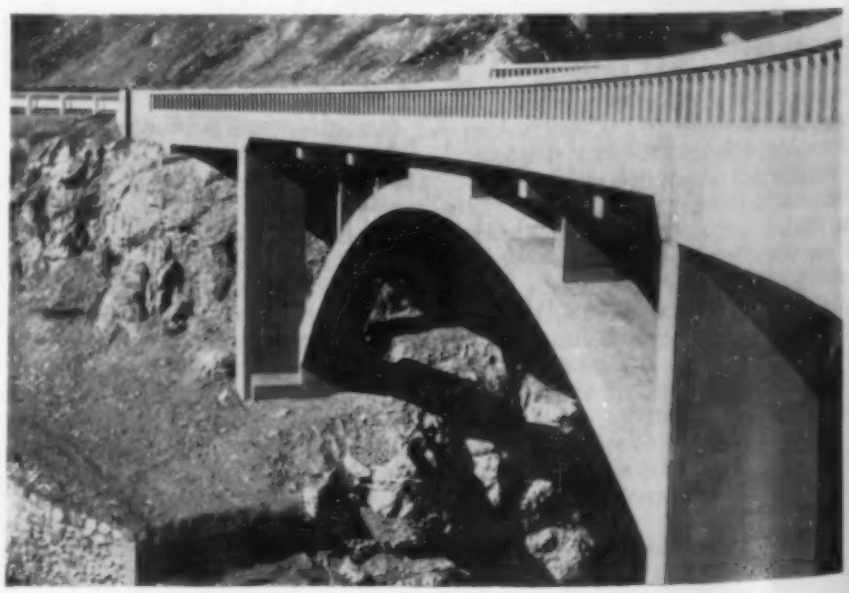
Route 207, when completed, will provide the shortest route from the City of San Bernardino to the resort area around Big Bear Lake and an alternative route to Lake Arrowhead. Traffic over this highway will therefore generally be pleasure bound for the recreation centers in the mountains. Two bridges on the 14-mile route are visible from the approaching highway, and their appearance is of sufficient importance to warrant special efforts.

One of these bridges, the crossing at East Fork City Creek, has good foundation conditions, a 70-ft-deep ravine providing an appropriate setting for a short concrete arch span. The highway at this point is, however, on a 300-ft radius of curvature.

Comparative estimates of viaduct and arch-type structures were so close that no appreciable saving could be shown for viaduct construction. Nor did the preliminary study indicate any possible combination of span lengths that would produce an architecturally pleasing viaduct in harmony with the lower bridge, a concrete arch, which was only $1\frac{1}{2}$ miles away. The unsymmetrical shape of the ravine, especially the vertical west bank, precluded the use of a three-span beam structure or even a symmetrical four-span structure. The arch design was adopted.

It was evident that the satisfactory solution of this problem would require the closest coordination of architect and engineer. The design, therefore, was divided into four stages: Basic engineering analysis, an architectural study, final engineering analysis, and architectural review. This work was all done in the Bridge Department design section, which includes an architect in addition to the structural designers.

The first step in the design was to determine the most suitable span, rise, and other proportions. A span of 100 ft and a rise of 20 ft were selected for the basic design. Offsets to the curb lines at the various panel points were computed and a skeleton plan and elevation were made from these



ROCKY WALLS OF 70-FT RAVINE provide good foundation conditions for concrete arch. Design difficulties stemmed from fact that highway is on 300-ft-radius curve at this point.

data. Next the proportions of piers and approaches were studied, and details which would minimize the effect of variable overhang of each bracket due to the sharp curvature were designed. After some compromise between architectural and engineering problems, the architectural drawing shown herewith was prepared, completing the second phase of the design. In the third stage arch analysis and design of approaches, piers and abutments were completed. Minor design changes were made during this stage, some of which affected the appearance of the structure, such as length of the east approach span, height of east abutment and a change in curb line over the deck slab on the arch. The latter change permitted a continuous facia from end to end of the structure, decreased the prominence of the variable-length brackets, and provided greater continuity of theme. The engineering drawings were again reviewed for appearance and, after minor changes, were submitted to the Bridge Engineer for approval.

Construction of the bridge proceeded without difficulty. Bedrock, slightly fractured pink granite, was encountered at the elevations determined in the preliminary field investigations. After the overburden was removed, footing areas were trimmed with ordinary pneumatic pavement breakers and hand tools.

The structure was completed in the late summer of 1948 by the Bridge Department, California Division of Highways, under the direction of George T. McCoy, M. ASCE, Highway Engineer, and F. W. Panhorst, M. ASCE, Assistant Highway Engineer, Bridges. Contractors on the job were Westbrook & Pope, of Sacramento, Calif. The cost of the bridge was $68,475.14.

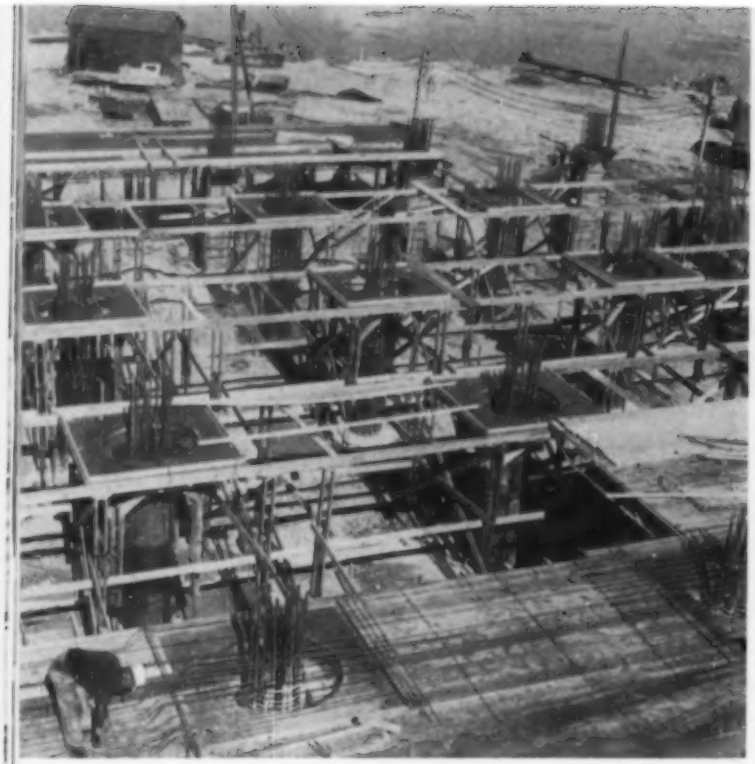
SHARPLY CURVED HIGHWAY IS SUPPORTED on straight-decked arch. Load along curb is carried to arch by offsets at panel points.

Rail-Mounted Equipment Speeds Concreting of Aspen Tunnel

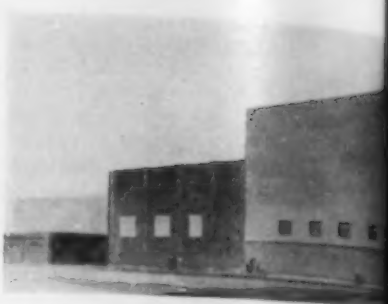
CONCRETE MIXING, pumping and placing equipment, all rail mounted, is being used to line the 6,700-ft Aspen Tunnel of the Union Pacific Railroad in western Wyoming. From the dry-batching plant, located a quarter of a mile from the east portal, the 1-cu yd batches move into the tunnel in narrow-gage dump cars. These cars run up a track-mounted incline to drop the batches, one at a time, onto a 30-in. conveyor belt feeding the dual mixer. From the mixer the Pumpcrete moves 35 cu yd of concrete per hour through an 8-in.-dia, 180-ft-long "shooting pipe" positioned by a jumbo to discharge at the top of the forms. At frequent intervals the track-mounted dump-car incline, mixer, Pumpcrete and shooting pipe are moved forward several feet as a unit. The two forms used are also track mounted. Completion of the tunnel, which will eliminate the Union Pacific's only stretch of single track between Omaha and Salt Lake City, is expected this fall. The contractor for this $8,000,000 project is the Morrison-Knudsen Co.

TUNNELMEN WORKING from jumbo (left) weave inner and outer curtains of reinforcing steel. Steel beams and timbers lend further support. Finished tunnel dimensions are 26 × 18½ ft. Lining is 2 ft thick except at invert, where it is 2½ ft. About 60,000 cu yd of concrete will be required to blanket 5,000 tons of reinforcing steel.

DUAL MIXER and Pumpcrete (right) feed concrete through "shooting pipe" in foreground, which extends up through jumbo (behind photographer) to top of forms. Beyond mixer is incline for dump cars and conveyor belt. Electric lights along left tunnel wall lead to white spot more than 3,000 ft distant, which marks east portal of tunnel.



RATE OF 48 cu yd per hour was reached in pouring third-floor slab. Bethlehem forms and reinforcing bars are used in columns.



COMPLETED WAREHOUSE (right) has trainshed on south wall, which permits all-weather handling of stored material. Row of five windows in west wall, shown here in architect's concept, was removed in final plans and replaced with air intakes on each floor. Total building height is 94 ft from basement floor to top of roof.

Efficient Con Warehouse

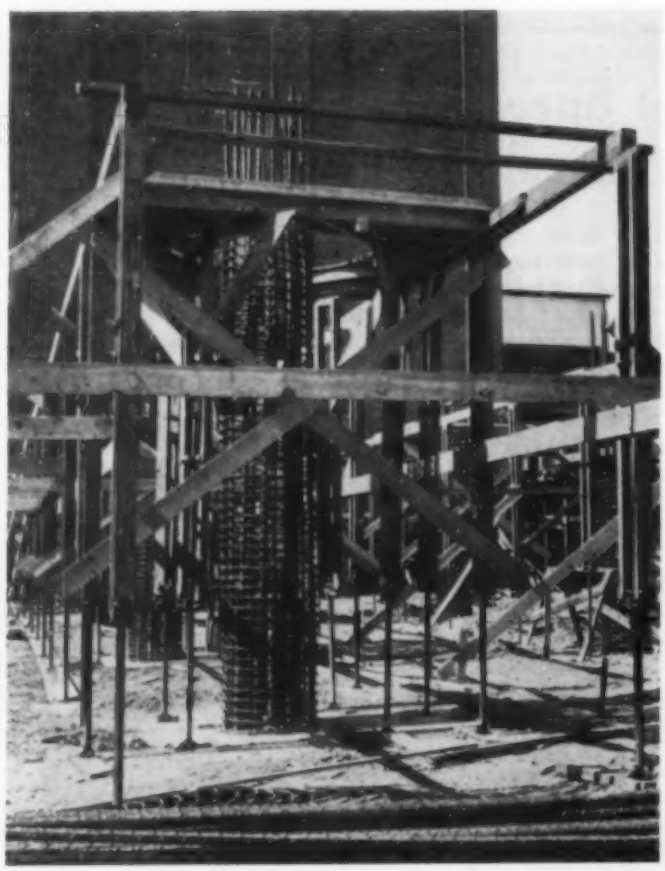
RAY NUNEZ

Construction Superintendent, F. H. McGraw & Co., Engineers and Constructors, Hartford, Conn.

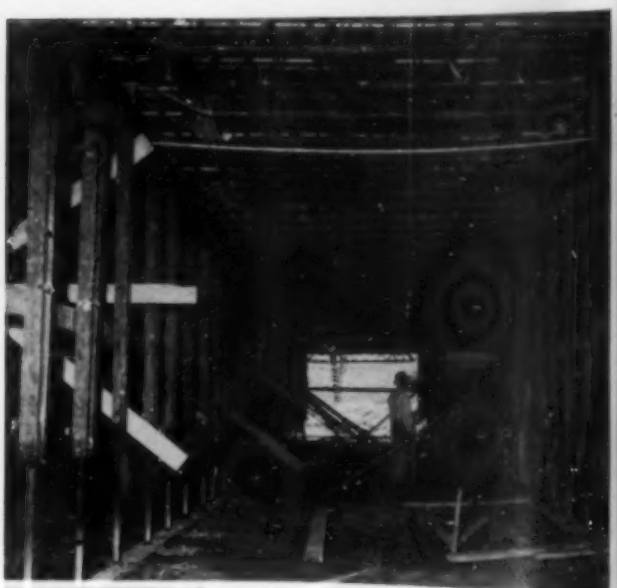
USE OF SPECIAL FORMS and efficient concrete pouring techniques are speeding the construction of a reinforced concrete warehouse being built for the Kimberly-Clark Corp. in Neenah, Wis. The contractors, F. H. McGraw & Co. of New York, hope to have the six-story structure completed in December although construction started only last May.

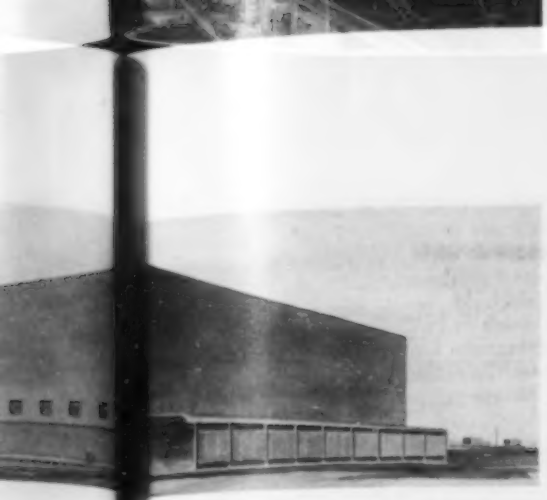
The warehouse, containing 262,500 sq ft will be used to store creped wadding. Since the building will be used exclusively for storage there is no need for windows, and air circulation is provided artificially. Only certain sections will be air conditioned. The heaviest floor loads naturally occur on the first floor, which is designed for 350 lb per sq ft. The second floor is designed for a loading of 250 lb per sq ft and the remaining floors for 200 lb per sq ft. The solid brick wall rests on the foundation for the first two stories and thereafter is carried partly on angle irons anchored to the floor slab.

As the ceiling heights vary from 12 to 14 ft, the contractor was confronted by the costly requirement of making many vertical falsework supports of different lengths for the forms of the floor slabs. To reduce this expense, variable-length supports were devised, which are set on 3,000-lb jacks so that they can be adjusted to the required ceiling height.

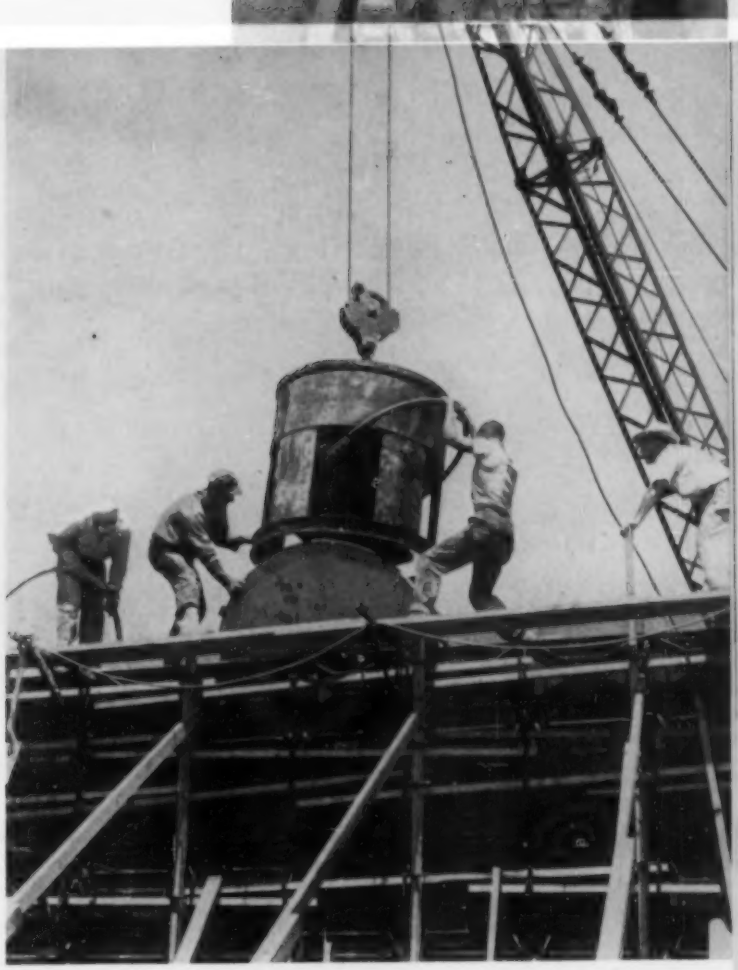


REINFORCED CONCRETE basement columns (above) of 30-in. diameter are spirally reinforced. Falsework supports forms for drop heads. Jacks under vertical supports (right) permit adjustment of their length so that falsework can be reused on each floor although ceiling heights vary from 12 to 14 ft. Steel trusses across ceiling support forms for first-floor slab.





WORKMEN dump bucket of concrete into wall forms (right). Man at left is operating vibrator, while man second from left moves funnel-like guide under concreting bucket.



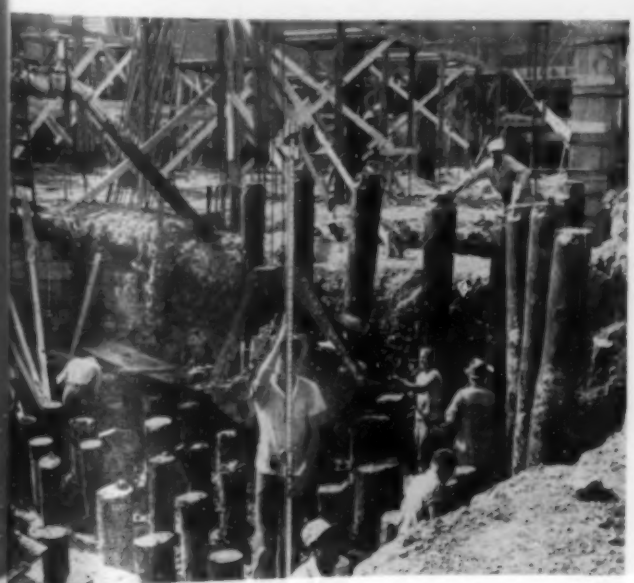
creting Speeds Construction

To speed pouring of the first-floor slab, the superintendent designed an inclined ramp which provided direct access to the street. The ramp, 20 ft wide and 10 ft deep and inclined at an angle of 30 deg, was placed on the street side so that the ready-mix trucks could drive up to the foot of it. The concrete could then be picked up in 10-cu ft Bell prime movers, carried up the ramp, and poured. A rate of 40 cu yd per hour was reached using this method. For pouring the second floor and above, the transit-mix trucks dumped the concrete into hoppers. The concrete was then dumped into a skip on an elevator and thence into a hopper on each floor, where it was picked up in motor buggies and poured. On these upper floors a concrete pouring rate of 48 cu yd per hour was attained.

The concrete columns supporting the first-floor slab are of 30-in. diameter and have drop heads. Columns supporting the second to fifth floors are 20 in. in diameter, and those above are 16 in.

To facilitate all-weather loading and unloading of the stored materials, the plans provided for an enclosed trainshed 33 ft wide along the entire south wall of the warehouse. The outer wall of the shed acts as a retaining wall to take the lateral thrust of the heavy train loads on the fill inside the shed. About 8 ft of backfill will be placed around the trainshed area. Surface contours permit pouring of the wall entirely above ground.

The warehouse was designed by the engineering staff of the Kimberly-Clark Corp. and built by F. H. McGraw & Co., with the writer as construction superintendent.



CREOSOTED WOODEN PILES (left) driven in one corner of building site where adverse soil conditions were encountered, were capped by reinforced concrete slab later poured over all 217 piles in group. Remainder of building rests on spread footings. Bottom-dump bucket (above) picks up ready-mixed concrete to pour retaining wall for trainshed. For erection of wall, which will be backfilled for height of about 8 ft, Economy forms were used.

ADMINISTRATION BUILDING for Broome County Airport is of brick with sheet aluminum tower. This type of design would lend itself easily to use of cement or cinder block for walls, with cement base paint, which would be considerably cheaper. Parapets around observation deck might well be replaced by railing, affording further economy.

Skillful Design and Careful Administration Cut Airport Costs

ELWYN E. SEELYE, M. ASCE

Seelye, Stevenson & Value, Consulting Engineers, New York, N.Y.

IN EVERY SUCCESSFULLY engineered airport there are three main considerations: A suitable and adequate design, effective supervision, and efficient administration of the contracts. The engineer charged with building an airfield, or any structure for that matter, must carefully plan his work to fulfill these requirements if he is to serve his client satisfactorily.

Perhaps the most important consideration in the economical design of an airport is the selection of the pavement section, its base and subgrade. Very often for economic reasons fields are built in low areas and on soft ground where it is impracticable to lower the ground-water level. This means designing a crust of pavement base and subbase capable of distributing the concentrated wheel loads to such a point that the soft subgrade will not be overstressed. Selection must be based on a thorough knowledge of the supporting power of the soft subgrade. The California Bearing Ratio Method, which is most commonly used, is one way of determining the supporting power. This method is based on a comparison of the resistance of the soil being investigated to the jacking through it of a tube of given size with the resistance of a layer of broken stone to the same tube driven in the same way. Curves have been plotted comparing the wheel-load supporting power of soils of different percentages of resistance with that of the broken stone.

Another method, the Plate Load Test, is designed particularly for use with the Westergaard formula, for designing concrete pavements, and also for simulating full-size levels. The Army made a series of these tests on test runway sections. The writer correlated a study of these tests to see how closely the California Bearing Ratio, the Rolling-Load Tests, and the Plate Tests coincide. The results indicate that the California Bearing Ratio forms a very good method of forecasting the ability of the subgrade to resist the rolling-load test. This correlation has been published in an article by the writer (*Engineering News-Record*, May 1, 1947, p. 733).

Prescribed tables for determining the required thickness of the subgrade have been set up by the Civil Aeronautics Administration. Subsoils are classified according to frost conditions, drainage, and the physical properties of the soil, and subbase materials, both granular and capable of compaction, are defined. When the wheel load is known, the required thickness of subbase may be determined from the tables.

Good Drainage Essential

The subject of drainage can generally be divided into two categories—subgrade and surface drainage. The latter may be further subdivided according to type of channel, such as swales, and trench drains located alongside, or inlets built into the edges of the pavement. Subgrade drainage should be used only to lower over-all water tables, and not to provide a system of drains under the entire runway area, as the latter would be excessively costly. The water table must be lowered to improve the character of the subgrade, and to keep adverse conditions from arising when the frost line reaches the water table. It is this action of the freezing of pore water below the capillary rise that causes the formation of ice lenses which heave the soil and crack pavements.

If the subsurface drainage is used solely for lowering the water table, it is then necessary to provide a surface drainage system to handle the runoff of rain storms and melting snow. The cheapest method is to use swales that drain the runways and, in turn, are drained by catch basins. However, this method is not entirely satisfactory in the winter when snow removed from the runways is piled along the edges of the pavement. The snow piles form a barrier to water draining into the swales, and the drainage, instead of being carried off, forms ponds on the runway which freeze with a drop in temperature, thus becoming a hazard to the operation of the field.

A much better, though more costly, method of handling surface drainage is to construct gutters alongside the runway leading through inlets and then to drains. Since these drains can be cleared at the same time the runways are cleared, they are always free to carry off the surface water. After the soil condition and drainage problems have been solved, the engineer's next consideration is the layout of the runways. Considerable economies can be effected here if careful study is given to the type of aircraft expected to use the airport, and the latest developments in landing devices.

Field layouts should be made with particular attention to the efficiency of ground handling of aircraft. This is important from an economic standpoint, when one considers the flight time that can be lost on a field owing to incorrect planning of the taxiways.

It is obvious in Fig. 1 that Plane 1 cannot get in position to take off until Plane 2 has left the runway, unless

there is a taxiway, as shown by the dotted lines, serving the end of the runway. Such a taxiway would obviously speed up the headway between two takeoffs. The situation can be further aggravated by landing aircraft which cause further delay before a plane can taxi down the runway for a takeoff.

Delay in the air also means a great loss in efficiency. If adequate taxiway turnoffs are not provided to clear the runway, the next aircraft must delay its final approach.

In using a runway for landing purposes, a pilot must be able to bring the plane to a stop within 60 percent of the available runway length, which means that taxiway turnoffs should be provided at or near the third points. Depending on the length of the runway and the type of small aircraft that might use it, additional turnoffs should be provided in between these. This contributes materially to expediting ground movement. The cross-hatched taxiway outlets, Fig. 1, are at about the third points of the runway.

Broome County Airport, New York, is a good example of how the engineer was able to save his client the cost of paving one landing strip and the placing of additional embankment. A third runway is provided. This runway is short and unpaved but adequate for light aircraft, which do not have the cross-wind landing capacity of the heavier commercial aircraft. The remaining two paved strips should meet all the requirements of commercial traffic.

Allow for Future Expansion of Field

The Rochester Airport, Fig. 2, demonstrates how the initial cost of constructing an airport may be reduced by building only the runways that are needed for current operation and allowing for future expansion as the need arises. Arrangements there permit Runways 1 and 2 to be used concurrently with the new instrument runway, provided they are under proper control such as by two-way radio. In this way, light planes and National Guard planes may continue to use the runways without interfering with the new east-west instrument runway. The layout also permits the extension of these runways so that they can be used by air-freight lines.

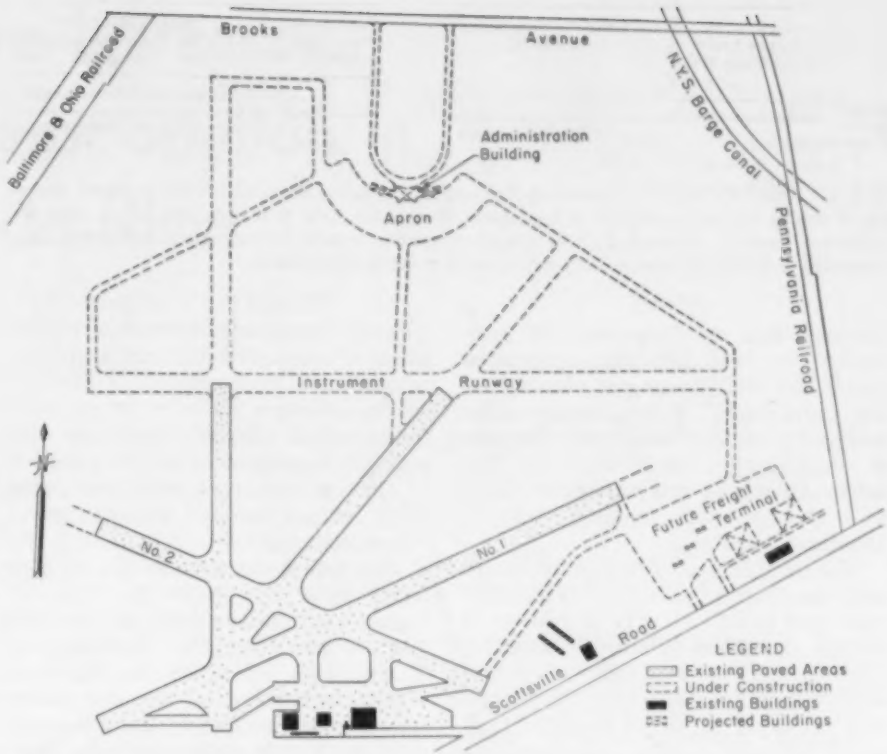


FIG. 2. BUILDING only those runways needed for current operation considerably reduces initial costs at Rochester Airport. Provision is made for future expansion.

More and more attention is being paid to laying out fields so as to give minimum approaches in all weather. This means a more restrictive attitude in locating airfields with regard to obstacles.

Airports are supposed to develop into self-supporting projects or, at least, into an economic balance where the subsidy from the town is not too great and yet is sufficient to attract business. In designing the administration buildings, the engineer would do well to balance carefully expenditures against intangible benefits. There is no question that the esthetic value of the administration buildings is important. However, it would be wise to search for materials that are easy on the client's pocketbook as well as pleasing to the eye.

The use of reinforced concrete with plywood forms and painted concrete eliminates the necessity of plaster, produces a pleasing interior, and is considerably cheaper than plastered interiors. This technique is now being used in modern low-cost apartment buildings. Further savings may be realized by the elimination of basements, use of railings instead of parapets around observation decks, and use of cinder blocks where possible.

It is questionable whether another story should be added to the observation tower, merely for appearance sake. It is equally questionable to provide extra rental space before such space is necessary. The better practice would be to provide for future expansion when and if the need arises.

Though radiant heat is initially more expensive, reduced operating costs usually make this type of heating economically advisable. Certainly it adds to the cleanliness and neatness of the buildings and the comfort of the public.

It is also most important to provide suitable storage, maintenance, and repair facilities for the aircraft using the airport. Of the many types of

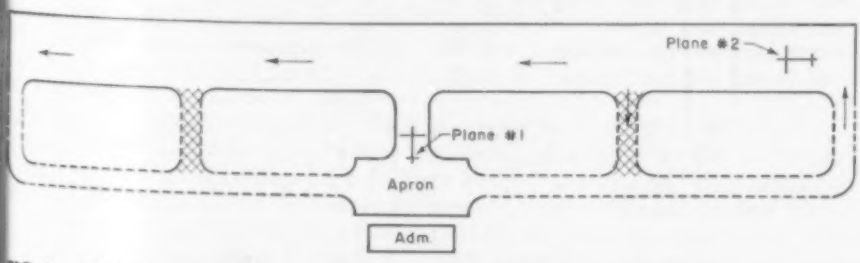


FIG. 1. ADEQUATE TAXIWAYS at ends of runway permit Plane 1 to move into take-off position while Plane 2 is still on runway. Taxiways at third points permit landing aircraft to leave runway quickly after landing.

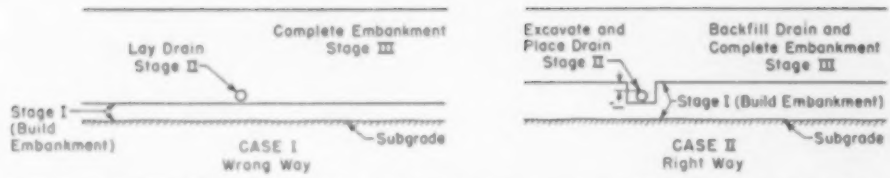


FIG. 3. EMBANKMENTS in which drains are to be placed should be filled to a foot above top of drains and pipes placed in trenches. Backfilling only to invert, and laying pipe on surface of backfill, although it saves cost of excavating trench, leaves pipe unprotected from extensive damage by contractor's heavy earth-moving equipment.

hangars, the multiple-plane is generally the best because it requires much less wall space per plane than the individual T-type hangar. The cost per plane of the hangar structure is significantly reduced, and the larger structure can easily be fitted with the necessary repair and maintenance facilities.

The problem of fire protection in any structure of this type is a major one, and installation of a system of deluge sprinklers is almost essential. This means either a tank at ground level with a booster pump and a 250,000-gal capacity, or an elevated tank of 50,000-gal capacity. The low tank is preferable in most cases, as the elevated tank constitutes a flying hazard. The presence of deluge sprinklers should not preclude the addition of foamite apparatus in the fire protection system.

Effective Supervision

Effective supervision includes not only seeing that the plans and specifications are followed, but meeting problems that arise after construction starts and solving them effectively.

As an example, the Fort Dix airfield, which was enlarged by the writer during the war, was built on a beach formation varying from coarse to fine sand and silt with occasional pockets of peat. After removing the peat pockets, occasional soft spots were discovered during the process of consolidating the fills. Examination showed that the spots were caused by lenses of silt and clay, which trapped water in these local areas. Auger holes were put down and filled with sand in order to drain the lenses, with entirely satisfactory results. The use of sand piles which, by the way, as many seasoned engineers will testify, are not a postwar invention, solved a condition that did not appear until field work had begun.

Adequate specifications are the backbone of effective administration. Care in the preparation of specifications can insure efficient construction procedures, and also save the client the expense of costly extras. Take, for instance, such a stock clause as the following and try to make it cover varying conditions: "In case stockpiling of excavated material and later rehandling of such material is directed by the engineer in order to produce the specified subgrade structure, the material so rehandled will be paid for at the contract unit price per cubic yard for unclassified excavation or common excavation."

The foregoing sounds like a perfectly clear clause—in no way ambiguous and satisfactory for an average earthmoving job. But suppose a stratified formation is involved, where the soil horizon consists of top soil, decayed rock, soft and shattered rock, and hard shale down to limestone. The ordinary sequence of excavation will deliver the excavated material to an embankment in the reverse order, that is, with the soil at the bottom and the hard rock at the top. Since the ideal embankment consists of lower courses of hard rock, then broken rock, then decayed rock, then topsoil, there are grounds for argument as to the necessity for stockpiling.

Is the engineer going to require the contractor to stockpile his topsoil and softer rock and then replace it in the embankment, and thus pay double for it? Or is he going to require the contractor to arrange his construction methods so that it will not be necessary to stockpile? In the latter case, will the contractor be able to say that such interference with his methods is contrary to economical job procedure, and that he is therefore entitled to an extra?

The better procedure would be to add a clause so that the contractor will know when he is bidding that he must so arrange the sequence of his work that the logical order of the layers in the embankment will be maintained without extra cost to the owner.

In contrast to the sort of situation just cited, which applies in cases of stratified soil, the Denton Airport in Texas has gumbo clay running down to an E7 or A7, according to whether the Civil Aeronautics Administration or Bureau of Public Roads designation is used. The specification required undercutting and refilling with granular material at a unit price in places where the soil was not compressible. As undercutting was expensive, the inspector in some cases required as many as 100 passes, and even these did not achieve the desired compaction. A clause limiting the number of passes that could be required by the inspector before undercutting would have eliminated an arbitration which gave an award to the contractor.

Experience has taught us that a specification for one type of soil horizon does not suit all soil horizons. As previously stated, the specifications should be written with proper construction sequence and method in view.

In one contract which required the placing of drains, the specification called for the contractor to be paid a unit price for excavation for the drains in cut areas; in fill areas the embankment was to be carried up to the level of the invert of the drains. The drains would then be built, and the embankment placed on top of them. The contractor's superintendent and the resident engineer agreed that the contractor could place his fill and excavate for drains later. The contractor then made a claim for payment for excavation for drains in fill areas.

The original specification contemplated a sequence of construction that would be awkward for the contractor to follow as his drains would be totally unprotected from the construction equipment performing subsequent embankment.

A good system in this case would have been to specify that the embankment be carried up a foot above the top of the drains (Fig. 3). Trenches would then be dug for the drains, the pipe would be placed, and the trenches backfilled. This method would have protected the drains from injury by the contractor's equipment, and costly arbitration would have been avoided.

Time and Budget Control Important

The engineer should watch the progress of the work. While this is primarily a function of the contractor, it is the engineer's responsibility to his client to see that the contractor is not proceeding in such a way that he will not meet the time limit. A bar graph posted in a conspicuous place on the job and made the basis of reports to the home office, is an excellent method of gaging the progress of the work.

Another very important matter in administration is that of keeping to the budget. Generally, the main

(*Continued on page 93*)

Low Temperature Increases Sediment Transportation in Colorado River

E. W. LANE, M. ASCE, Hydraulic Consultant, E. J. CARLSON, Hydraulic Engineer, and O. S. HANSON, Hydraulic Engineer

Bureau of Reclamation, Denver, Colo.

TEMPERATURE exerts a material effect on the transportation of sediment by flowing water, according to considerable evidence collected by the Bureau of Reclamation. Perhaps the most striking indication is in the record of sediment discharge above the Imperial Dam, a Bureau structure on the Lower Colorado River, which was called to the writers' attention by Roy E. Goss, Hydrographer, Bureau of Reclamation, Yuma, Ariz. The data indicate that a much larger load of sediment is carried by the river during the winter than during the summer with approximately the same flow. Since the only apparent explanation for the quantitative difference in sediment discharge at these two periods of the year is the difference in water temperature, the phenomenon initiated a general inquiry into the probable effect of temperature on the transportation of sediment in flowing streams.

Results of the observations are shown in Fig. 1, which gives the water discharge, water temperature, sediment concentration and sediment load at the Taylor's Ferry sediment sampling station (Fig. 2) on the Colorado River from 1943 to 1947, inclusive. These data were collected by the Office of River Control, U.S. Bureau of Reclamation, Boulder City, Nev., under the direction of C. P. Vetter, M. ASCE. It will be noted that, for a given discharge, the sediment load may be as much as $2^1/_2$ times as great in winter as in summer. The conditions in this reach of the Lower Colorado River are exceptionally favorable for indicating any effect temperature may have, as the number of variables that might effect the sediment load is much less than in most rivers.

Sampling Station Well Situated

The sampling station is located downstream from Lake Mead (behind Hoover Dam) and Lake Havasu (behind Parker Dam), in which the sediment coming down the Colorado is deposited, so that the discharge is clear. Because of the regulating effect of these two reservoirs, the flow of the river is unusually uniform. There is very little local inflow between Lake Havasu and Taylor's Ferry and the sediment carried by the river is almost entirely picked up from the streambed. Approximately 70 percent of this load is composed of fine and very fine sand. The river is therefore much freer than most streams from great fluctuations in water discharge and in load of sediment brought into it by tributaries. Because of the relatively constant conditions, the effect of temperature is much more apparent than in an ordinary stream.

It will be noticed that although the sediment concentration fluctuates, being generally larger in winter than in summer, there is distinct tendency for the sediment concentration and sediment discharge to become smaller with the passage of time. This tendency is due to the gradual coarsening of the river bed from which the load is picked up. Size analyses of the bed and suspended sediments show that they have gradually become coarser, and as the bed has become coarser, the water has been unable to pick up as large a load as before, but the particle size of the material which it does pick up is coarser. The principal changes in sediment load are therefore due to changes in amount of water discharge, coarsening of the bed, changes in water temperature and possibly some other unknown cause which fluctuates with the seasons and may be wholly or partly the effect of temperature.

FIG. 2. LOCATION of Taylor's Ferry sediment sampling station on Colorado River is exceptionally favorable for showing effect of water temperature on amount of sediment carried in suspension. Sediment in reach is almost entirely picked up by river from its own streambed, as load from upstream has been settled out in Lakes Mead and Havasu. Regulation of upstream reservoirs gives constant flow and there is very little local inflow from tributaries.

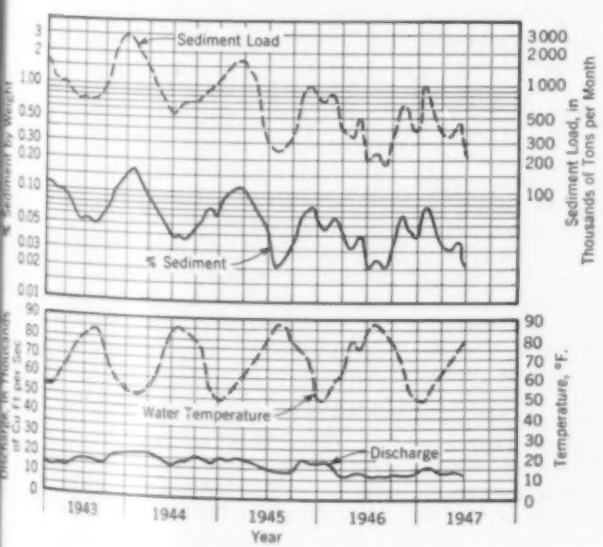


FIG. 1. Correlated and plotted measurements of sediment load, water temperature and river discharge at Taylor's Ferry Station on Colorado River show that sediment load increases as temperature of water falls. For a given discharge, sediment in suspension may be $2^1/_2$ times as great in winter as in summer.

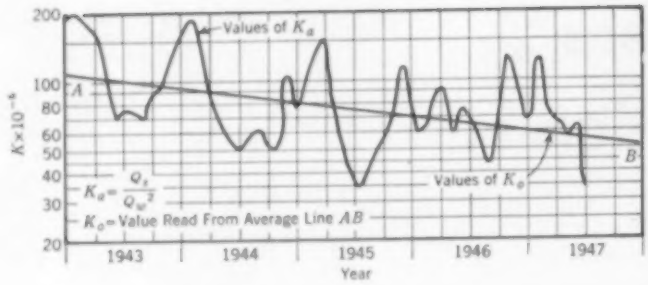


FIG. 3. RELATIVE MAGNITUDE of sediment load had discharge been uniform is shown by plotting values of constant K_a (found for all sediment observations) against calendar time. Slope of line is due to coarsening of bed with passage of time.

An attempt was made to compute the magnitude of the fluctuations assumed to be due to temperature, by eliminating the effect of the variation of water flow and streambed coarsening. The first step was to eliminate the effect of water discharge. From many observations it has been found that the sediment load in natural streams varies roughly as the square of the discharge. This fact is expressed by the equation $Q_s = K_a Q_w^2$, in which Q_s is the sediment load in tons per day, K_a is a constant, and Q_w is the water discharge in cubic feet per second. The values of K_a were found for all the sediment observations and plotted against calendar time. The resulting graph, Fig. 3, shows approximately what the relative magnitude of the sediment load would have been had the discharge been uniform.

An average line, AB, was then drawn through the values of K_a, sloping gradually downward to indicate the approximate variation which the value of K_a would have had if temperature fluctuations had not been present. The slope of the line, and the lower values of K_a represented by it, are due to the coarsening of the bed as time goes on. The ratio of the values of K_a (as computed from the observed data) to the value of K_o (obtained from this average line) should give a comparison of the magnitude of the fluctuations due to temperature.

The magnitude of the ratio of the fluctuating K_a value to the gradually changing K_o value of the average line was plotted against the water temperature at the time of observation, with the result given in Fig. 4. This figure shows that the ratio decreased with increasing temperature at a rate sufficient to make the average load at the time of lowest temperature about $2^1/_2$ times the average load at the time of highest temperature.

It will thus be seen that whether or not this fluctuation is due to temperature, it is of so large a magnitude that its cause must be determined if accurate analyses are to be made of many sediment actions in the Lower Colorado River and other similar streams. The sediment load shown in Fig. 1 is the total load carried by the stream. Computations were carried out to determine whether the effect of this cause was the same on particles of different sizes. The total load was broken into four parts, each part composed of particles of a small size range, the four parts covering the entire range of sizes carried, which was from 0.044 mm to 0.589 mm. The load in each size range was analyzed in the same way as previously described for the total load. For sizes from 0.044 mm to 0.295 mm the temperature effect seemed very close to that shown in Fig. 4. For the size 0.295 mm to 0.589 mm, the change with temperature was negligible.

This analysis shows that the change in load due to temperature change occurred almost entirely in sediment of sizes smaller than 0.3 mm.

The results shown by the 1943 to 1947 data were confirmed by the records collected at Red Cloud Cable, Taylor's Ferry and Imperial Damsite for the years 1935 to 1942, inclusive. During 1935–1942 the sediment load and water discharge were determined by measurement, but the water temperature was not recorded. In preparing these data, a curve of the fluctuation of temperature throughout the year was drawn up by averaging the temperature curves as determined for the years 1943 to 1947. This curve showed practically the same fluctuation of sediment load with temperature as obtained for the years 1943 to 1947, but the scatter of the points was greater, probably because the actual temperatures varied somewhat from the values obtained from the average temperature curve.

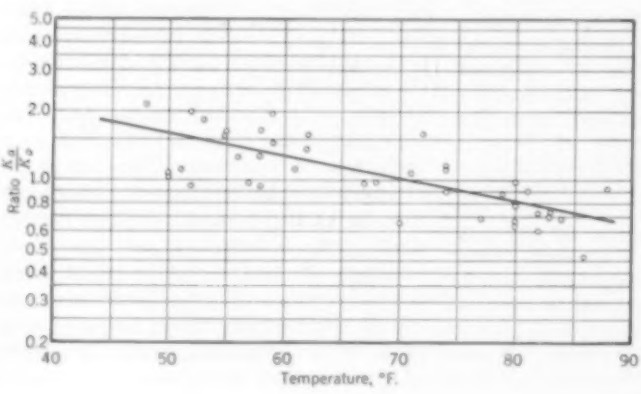


FIG. 4. SUSPENDED LOAD carried by Colorado River varies inversely with temperature of water, according to data collected at Taylor's Ferry sampling station during period 1943–1947. Graph was prepared by plotting ratio K_a/K_o from Fig. 3 against water temperature as determined at time of observation.

Problem in Movement of Suspended Load

Since most of the sediment load of the Lower Colorado River is carried in suspension, the results should be analyzed as a problem in the movement of suspended load. The fluid mechanics of this phenomenon is now fairly well understood as regards the transportation of the sediment particles after they have been raised from the bed into suspension by the effect of turbulence, but a satisfactory analysis of the raising of the particles from the bed to combine with this transportation in suspension has not yet been worked out. The effect of temperature on the transportation of sediment already in suspension is due to its effect on particle settling rate, but the magnitude of these effects is much less than of those indicated by the Lower Colorado River observations. Since the temperature effects on transportation of sediment already in suspension are of lesser magnitude, it follows that most of the effect of temperature observed in the Colorado River observations is due to the rate of picking up of material from the streambed.

The sediment study here described was part of an investigation of the control of sediment in the Middle Rio Grande, initiated by the Sedimentation Subcommittee of the Federal Interagency River Basin Committee. The study was carried out under the direction of J. E. Warnock, M. ASCE, head of the Bureau of Reclamation's Hydraulic Laboratories, Research and Geology Division, Branch of Design and Construction, in Denver, Colo. R. F. Blanks, M. ASCE, is head of the Division, and L. N. McClellan, M. ASCE, is chief engineer of the Bureau of Reclamation and Director of the Branch of Design and Construction.

The Engineer's Stake in Labor Legislation

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Assistant Secretary, American Society of Civil Engineers, New York, N.Y.

IN A RECENT ADDRESS before about 400 members of the American Society for Engineering Education in Troy, N.Y., Mr. Chandler reviewed in an objective fashion what has been going on in the field of unionism as it concerns the engineer, and indicated why the national engineering societies have deemed it incumbent on them to take an active interest in what has transpired. The Taft-Hartley amendment to the Wagner Act, which gives protection to professional employees, has not been changed, and there is little likelihood that it will be modified in the present (Eighty-first) Congress.

MUCH confusion and perplexity have arisen in the minds of both engineer employees and employers as a result of the fact that our national labor laws have substantially precluded open discussion between the parties directly concerned in employer-employee relationships. Largely for that reason, employee members have looked to their national engineering societies to lead them out of this wilderness of bewilderment. As for discussion other than that between employer and employee, there has been so much of it in recent years that is has been rather overwhelming at times. Even so, discussion has not been sufficiently widespread to promote understanding of this perplexing problem.

I do not propose to argue the case for or against labor unions or the overall objectives of labor laws, or to embark on a crusade for or against the activities of engineering employees in the field of collective bargaining. Rather it is my hope to present, in objective fashion, a review of what has been going on and to indicate why the national engineering societies have deemed it incumbent on them to take an active interest in the matter.

Origin of "Collective Bargaining"

Collective bargaining processes began in the United States more than a century ago, although Samuel Gompers is reputed to have introduced the term "collective bargaining" in connection with employer-employee relationships. As far back as the 1820's there were a few local unions, whose activities were however sporadic and desultory. It remained for the National Labor Relations Act of 1935 (Wagner Act) to provide a full-blown guarantee of the right of labor to organize and bargain collectively and to protect labor unions against specified "unfair labor practices" on the part of employers.

That Act continued in force without change until 1947, when the Labor-Management Relations Act, 1947 (Taft-Hartley Act), substantially modified its provisions in a number of important respects. In spite of assertions by labor leaders that the Taft-Hartley Act was designed to sound the death knell of labor unions and their collective bargaining rights, the unions have continued to grow, and collective bargaining, in most instances, seems to have proceeded in more orderly fashion than before.

The Wagner Act was drawn with the avowed purpose of favoring labor in its relations with management. As time passed, it became obvious that labor pressed its legalized advantages so far as to be harmful to the public interest in some important respects. Whereas at one time management was inclined to ride roughshod over labor, the pendulum swung too far in the other direction. The Wagner Act permitted labor by law to ride roughshod over management. One condition was as vicious as the other, and the general public was the loser either way. It was evident long before 1947 that steps should be taken to bring the situation into better balance with more equitable legislation which would require both labor and management to assume their proper shares of responsibility in solving the problems of labor relations.

"THE PROFESSIONAL MAN does not fit into the kind of organization or modus operandi of most labor unions. The attitudes, abilities and work characteristics of a professional man are not susceptible to standardization and regimentation in accordance with labor union criteria. It is a fundamental of labor union principles that quantity of work and compensation shall be standardized. This means that all, whether expert or inept, must be held to some standard of production, and obviously the standard must be at a low or mediocre level if it is to be within reasonable reach of all. On the contrary, the aim of professionalism is superiority of production. It is folly to attempt standardization of the genius and abilities of creative artists or of professional engineers in the conduct of their professional work. Whatever merit labor union principles may have with reference to the performance and products of labor, they are not applicable to professional services."

Early Professional Organizations

For many years, labor unions contented themselves with efforts to organize the trades and common labor. However, in 1918 the A.F. of L. amalgamated a group of technicians and subprofessional men into the International Federation of Technical Engineers, Architects, and Draftsmen's Unions (IFTEA and DU). In 1933, a group of independent unions of technicians organized the Federation of Architects, Engineers, Chemists and Technicians (FAECT) and affiliated with the C.I.O., later being absorbed into the United Office and Professional Workers of America, C.I.O. The two organizations now have an estimated combined membership of some 20,000. Although they have some professional members, they are heterogeneous in character. There are in addition several smaller organizations of professional and subprofessional employees.

Under the Wagner Act, it was not impossible for a group of professional employees to form their own bargaining organization but such action was complicated and difficult. As a result of the Act and interpretations and decisions of the National Labor Relations Board, professional engineers were required, in some instances, to join unions composed almost wholly of non-professional employees in the manual trades in order to hold their jobs. Other situations developed in which professional engineers found their collective bargaining right being claimed by unions with which they did not wish to be affiliated.

One of the best examples of what could happen is found in the case of the Shell Development Co., Inc., at Emery, Calif. In the early 1940's, 201 professional men, largely chemists, among whom there were 44 with the degree of Doctor of Philosophy, found themselves about to be forced into a heterogeneous bargaining unit with a

slightly larger number of non-professional employees. Among the latter were considerable numbers of roustabouts, janitors, window-washers, and the like. Quite justifiably the professionals raised violent objection and a long-contested struggle ensued. With financial and legal assistance from the American Chemical Society, the case was fought to a finish before the National Labor Relations Board, with the result that the professional men succeeded in gaining recognition for an organization of their own and were able to stand by themselves.

A similar situation arose at the Bloomfield, N. J., plant of Westinghouse Electric Corp., where professional engineering employees were included in a heterogeneous group. They were compelled to go out on strike, and their protests brought threats of reprisals. In spite of a petition for withdrawal, the National Labor Relations Board refused to grant their request for a separate unit under the Wagner Act. It was not until the Taft-Hartley Act opened the way that they finally succeeded in getting out of their predicament. Such circumstances were unfortunate and discouraging.

The profession was faced with stern realities. Labor unions made increasing inroads on the ranks of professional employees during the years following enactment of the Wagner Act. The professionals were inept in the field of labor relations. Overwhelmed by the tactics of experienced union organizers and without regard to their wishes, they frequently found themselves included in heterogeneous bargaining units almost before they were aware of what was going on. Once they were included, their protests usually were of no avail. Inevitably constituting a small minority in a large industrial organization, they were unable to choose their own representatives or to gain adequate opportunity to express their views. They became increasingly bewildered and discouraged.

It was natural for employee members to look to their national engineering societies for guidance and there developed a growing demand that something be done to help them. But the field of labor relations was new to the professional societies. None knew what course to pursue, let alone how to pursue it. Some leaders in the profession advocated exemption for all professional employees but it became evident that a very large number of employees did not want exemption. Even if desirable, such a program would have required amendment of the Wagner Act and there was no likelihood of such an event in the early 1940's. One society went so far as to contemplate denying membership to all who took part in collective bargaining, but that program was abandoned when sober second thought indicated the manifest injustice that would have been inflicted on those who, against their desires, had been included in bargaining units under rulings of the National Labor Relations Board.

"THE ESSENCE of the Taft-Hartley Law provisions relating to engineers is that a group of professional employees in any place of employment may decide, by majority vote of their own numbers, whether they want to form a unit of their own for collective bargaining purposes, to join with some other bargaining group, or to refrain from any action of the sort. That is a far cry from the old Wagner Act under which a group of laborers or production workers might form a collective bargaining unit and a few unfortunate professional employees might find themselves forced to become members or quit their jobs. At last professional employees have statutory protection."

Some valuable contributions resulted. The publication entitled "Technologists' Stake in the Wagner Act," produced by the American Association of Engineers in 1944, gave a comprehensive record of experiences under the Act, set forth in detail an explanation of difficulties that had beset professional employees, and described steps necessary for the formation of appropriate collective bargaining groups. The American Chemical Society contributed a major pioneering service in its support of professional employees in the Shell Development Co. case to which reference has been made.

Course Followed by ASCE

Events appear to have demonstrated that the American Society of Civil Engineers followed the most consistently constructive course. In 1937, the Society appointed a Committee on Unionization to study the extent of unionization among engineers and recommend to the Board of Direction suitable courses of action. In 1941, the committee was renamed the Committee on Employment Conditions and broadened its scope of action. As a result of recommendations from this committee, based on its survey of experiences of professional employees with labor union organizations and after study of the legal aspects of collective bargaining, the Board decided, in 1943, to undertake a positive program to provide means for the development of "professional units." In essence, this was purely a defensive tactic.

Early in its deliberations, the Board of Direction concluded that the most desirable long-range objective would be changes in the labor laws which would, at the very least, prohibit the forced inclusion of professional men in labor-dominated bargaining units and which would permit them to refrain from collective bargaining if they chose to do so. Unfortunately, that was a hopeless task prior to the 80th Congress. The immediate problem, in 1943, was that of helping professional employees to meet their problems under the provisions of the Wagner Act.

The Society published a manual, "The Engineer and Collective Bargaining," in July 1943, and later in the same year promulgated its suggested plan. Under this plan, preliminary steps of organization might be taken by a Local Section of the Society. In succeeding steps, Society participation became less and less, until, by the time a bargaining unit was created, the Society was entirely divorced from the proceedings. Not only was this procedure desired by the Society, it was a statutory requirement. Nothing is more fatal to recognition of a bargaining unit by the National Labor Relations Board than domination or influence by an employer and, since the Society is composed of both employers and employees, it is mandatory that it have no part in the functioning of a unit. The plan met with substantial success, as is attested by the fact that a number of professional engineering bargaining groups formed under its terms are currently in existence and functioning satisfactorily.

Looking forward hopefully to the time when there might be an opportunity to bring about amendment of the Wagner Act, the Society's Board of Direction adopted a statement of policy covering the principles deemed appropriate for the purpose. That policy was in three parts, as follows:

1. Any group of professional employees who have a community of interest and who wish to bargain collectively, should be guaranteed the right to form and administer their own bargaining unit and be permitted free choice of their representatives to negotiate with their employer.
2. No professional employee or group of employees, desiring to undertake collective bargaining with an employer, should be forced to affiliate with, or become members of, or to submit to representation by such a group or its designated agents.
3. No professional employee should be forced, against his desires, to join any organization as a condition of his

employment, or to sacrifice his right to individual, personal relations with his employer in matters of employment conditions.

As early as 1946, these principles were presented in a statement on behalf of the Society to a Subcommittee of the House Labor Committee of the 79th Congress. As it was late in the session, nothing resulted except the planting of the seed.

The Taft-Hartley Act

Thus the American Society of Civil Engineers, as a result of some ten years of intensive study and first-hand experience with the problems involved, and because it had adopted a definite policy, was in a position to provide the needed leadership toward amendment of the labor laws when opportunity presented itself during the first session of the 80th Congress.

Engineers Joint Council, through its Committee on the Economic Status of the Engineer, had undertaken an intensive study of the whole field and published an excellent "Manual on Collective Bargaining for Professional Employees" in 1947. Council represents the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Chemical Engineers. The National Society of Professional Engineers, although not a member of EJC, collaborated in preparation of the manual.

In 1947, Council adopted the beforestated principles as its official declaration of policy on which to frame legislative provisions in the interests of professional employees, and established a Labor Legislation Panel for the specific purpose of presenting the matter to Congress.

The American Society for Engineering Education and the National Society of Professional Engineers were invited to participate and each appointed a representative on the panel. The panel testified in support of the officially adopted principles before labor committees of the Senate and House. The American Chemical Society collaborated and presented a statement of its own.

The effort was successful, as the following quotations from the Taft-Hartley Act demonstrate:

"(12) The term 'professional employee' means—

"(a) any employee engaged in work (i) predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical, or physical work; (ii) involving the consistent exercise of discretion and judgment in its performance; (iii) of such a character that the output produced or the result accomplished cannot be standardized in relation to a given period of time; (iv) requiring knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study in an institution of higher learning or a hospital, as distinguished from a general academic education or from an apprenticeship or from training in the performance of routine mental, manual, or physical processes; or

"(b) any employee, who (i) has completed the courses of specialized instruction and study described in clause (iv) of paragraph (a), and (ii) is performing related work under the supervision of a professional person to qualify himself to become a professional employee as defined in paragraph (a)."

Section 9 (b) establishes the principles under which professional employees are guaranteed the right to have units of their own if they care to do so. Following is a quotation from that Section:

"Sec. 9. (b) The Board shall decide in each case whether, in order to assure to employees the fullest freedom in exercising the rights guaranteed by this Act, the unit appropriate for the purposes of collective bargaining shall be the employer unit, craft unit, plant unit, or subdivision thereof; PROVIDED, That the Board shall not (1) decide that any unit is appropriate for such purposes if such unit includes both professional employees and employees who are not professional employees unless a majority of such professional employees vote for inclusion in such unit;"

"EMPLOYER-EMPLOYEE RELATIONSHIPS in industry is a subject that well might be given increased attention in our institutions for engineering education. This subject is highly appropriate for classroom instruction or for discussion at meetings of Student Chapters of the Engineering Societies. Our young engineers should enter on their careers with some understanding of the human relationships involved. They need to give thought to the justifiable aspirations of labor and to the prerogatives of management, and to realize that they will find themselves somewhere between the two, with problems, opportunities and responsibilities peculiar to their own position."

Developments Under the Taft-Hartley Act

As a result of the Taft-Hartley Act, professional employees found themselves in a vastly improved situation. New opportunities were available, and with them, new responsibilities. The provisions of the Act regarding professional employees are so written as to apply to all who may qualify under the definition of "professional employee." Already there have been cases of interest. One of the first had to do with a group of "time study" employees of the Worthington Pump and Machinery Corp. of Holyoke, Mass. Although the National Labor Relations Board was split in opinion as to the appropriateness of certifying such employees, the majority ruled that they were entitled to a collective bargaining unit of their own as professional employees.

In another case it was ruled that newspaper people—editors, rewrite men, and reporters—are not professional employees under the definition of the Act, inasmuch as they are not required to undergo specialized training in an institution of higher learning. Again, attorneys employed by the Lumbermen's Mutual Casualty Company of Chicago were recognized as professional employees by the NLRB and formed their own unit.

The number of professional engineering employees now included in collective bargaining groups is estimated at some 18,000 or 20,000, somewhat more than half of these being in units certified by the NLRB.

Although the movement has become widespread, the greatest concentrations are to be found on the West Coast and in the Philadelphia–New Jersey area. Prominent in the West are the following organizations:

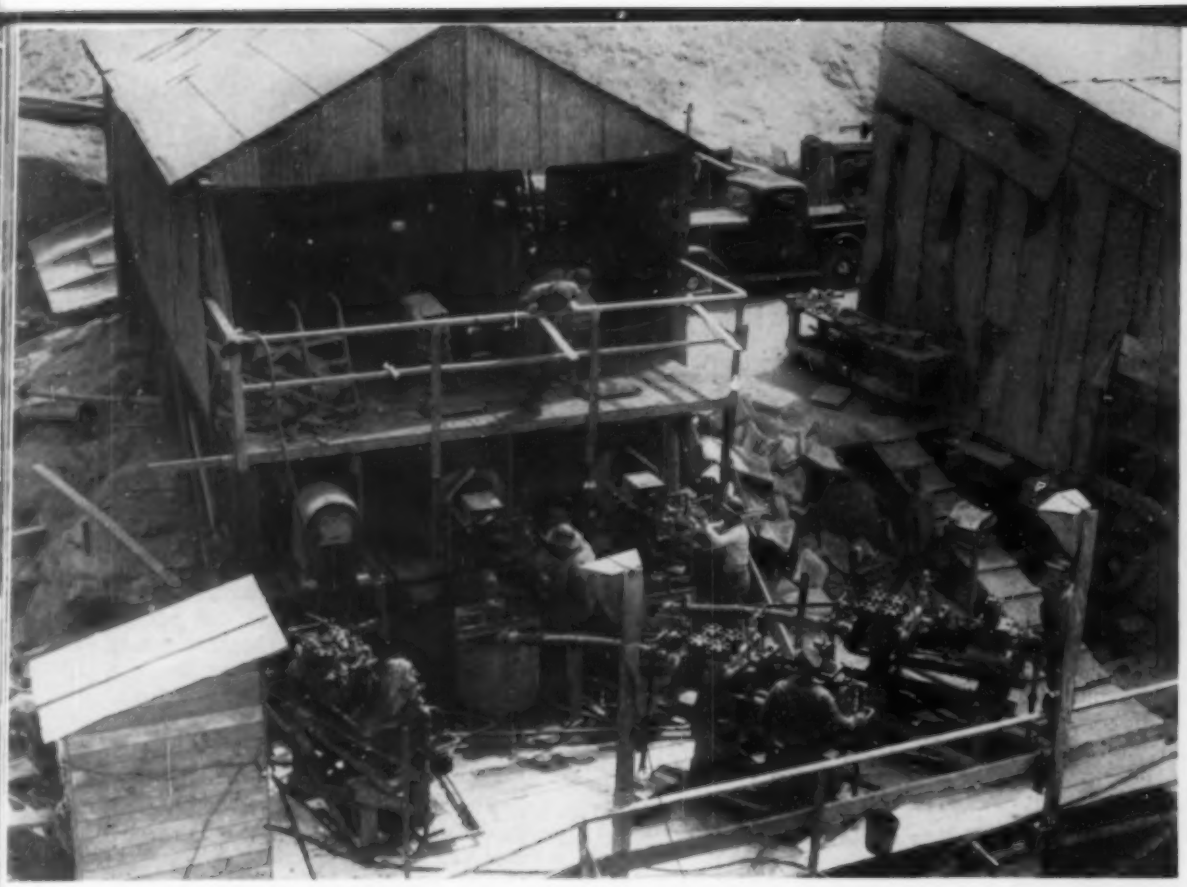
Seattle Professional Engineering Employees Association
Professional Engineer Employees Association of Eastern Washington
Southwest Washington Association of Professional Engineering Employees
Engineers Guild of Oregon
Sacramento Group of Professional Engineering Employees
San Francisco Group of Professional Employees
Southern California Professional Engineering Association

With a combined membership of some 3,000, these Pacific Coast groups have organized an inclusive National Professional Association of Engineers, Architects, and Scientists with the objective of coordinating their activities.

The Eastern Conference Committee of Independent Engineering Organizations is the coordinating body for six independent bargaining units. With a combined membership of over 5,000, a majority are employees of the Western Electric Co. in New Jersey. Others are in the employ of Sperry Gyroscope Co., Radio Corp. of America, General Electric Co., and Westinghouse Electric Corp.

It is doubtless true that most professional engineering employees never will have the slightest interest in

(*Continued on page 89*)



PLANT FOR GROUTING contraction joints is composed of three main parts—mixer, agitator tank, and pump. In plant here shown, for large-scale operation, cement is stored on top floor of structure, three mixers are mounted on floor below, agitator tanks are at ground level directly below mixers, and pumps are in foreground, two at right and one at left. Each combination of mixer, agitator tank and pump—all air driven—can grout about 100,000 sq ft of joint area per day

Grouting Contraction Joints in Dams Controls Cracking and Seepage

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GROUTING of contraction joints in dams is highly specialized work. This work cannot be done hastily, and requires thorough, detailed planning and preparation well in advance of each grouting of a set or zone of contraction joints. Each structure has slight differences in design and construction and these in themselves govern to a large extent the procedures and equipment required for an economical, well executed job of contraction-joint grouting.

Methods Used to Control Cracking

In the first attempts to control miscellaneous cracking, dams were divided transversely into blocks and the faces of these blocks were coated with a heavy oil, grease, water-gas tar, or asphaltic emulsion to prevent bonding. The openings between the concrete blocks could not be grouted and the only barriers to water seepage were the embedded water stops across each joint at the upstream face.

Another method of controlling cracking, used extensively in Europe and principally for arch-type dams, consisted of leaving an opening usually 3 to 10 ft in width between each block of mass concrete. The openings were later filled with concrete after expansion and contraction had taken place in the first-stage concrete.

Some of the methods then practiced solved the problem of controlling the direction of large-scale cracking in concrete; however, none of them prevented water from seeping into the artificially created cracks and eventually developing small but persistent percolation channels through the structure.

In the design of present-day concrete dams, provisions are made for contraction joints spaced at regular intervals from abutment to abutment and extending from bedrock to the top of the dam. In most cases, one set of contraction joints normal to the axis of the dam and extending from the upstream face to the downstream face is considered sufficient. In addition to transverse joints, the larger structures, such as Hoover Dam, Grand Coulee Dam, and Shasta Dam have longitudinal contraction joints which run parallel to the axis of the dam.

The size of the dam, the methods to be used in cooling the concrete, and the schedule of construction activities all have an important bearing on the size and type of equipment to be used, the procedure to be utilized, and the personnel to be employed in the grouting of the contraction joints. Procedures and techniques constantly require minor modification and adjustment for each new structure encountered.

Design and Construction of Joints

In dams more than 100 ft high, it becomes practical to grout the contraction joints in lifts. If lifts are higher than 100 ft, pumping pressures and water-cement ratios cannot be controlled satisfactorily. The design of the cooling system, that is, the degree of temperature control desired, and the construction schedule will determine the horizontal distance between joints. The vertical boundaries for each lift of each joint are governed by similar conditions. The boundaries are provided through the use of a separate piping system and grout-stop seal for each lift of each joint. See Fig. 1.

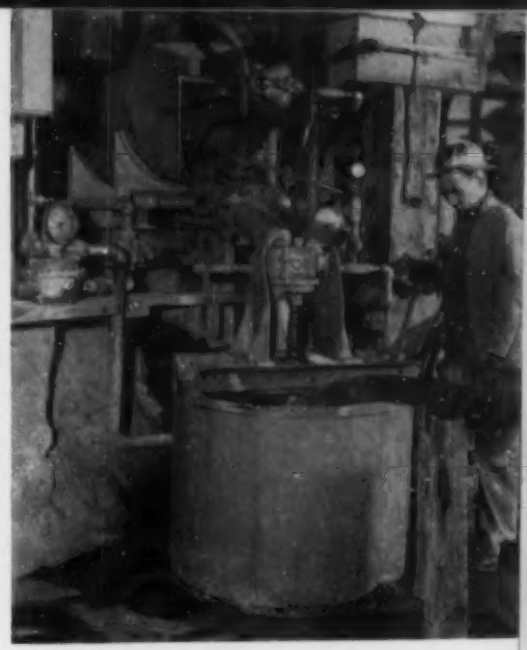
Each lift of each joint is bounded on the upstream and downstream face by vertical or inclined metal seals, commonly referred to as grout stops, which extend from the foundation rock to the crest of the dam. Vertically the lift is limited to 50-ft intervals by horizontal seals across the contraction joints, extending from upstream face to downstream face. In large mass concrete structures, it may be necessary to include longitudinal joints which are offset so as to be discontinuous from one abutment of the structure to the other. In the construction of longitudinal joints, the methods used for sealing lifts vertically and horizontally are the same as those used for transverse joints.

The patented pipe system used by the Bureau of Reclamation to fill the joint openings consists essentially of a supply pipe, a return pipe, small pipes with outlets rising vertically from the supply pipe and connected at regular intervals to the contraction joint, and a vent at the top of the lift. The number of pipes for each lift of the grouting system depends on the dimensions of the structure. Whether the supply pipes, return pipes, and vent pipes originate and terminate in the galleries of the dam, on the exposed faces, or at both locations depends largely on the design of the dam.

Installation of necessary piping systems and grout stops for each construction lift of concrete is completed just prior to the placing of the concrete in that lift. Inspection of each item to be installed requires methodical and accurate work on the part of the engineer. Before new concrete is placed, all metal sealing strips across contraction joints should be given a thorough visual inspection and any welds between sections of the seal should be tested by the soap-bubble method. Pipe and grout outlets must be securely anchored to prevent movement or crushing while concrete is being placed. The piping layout must be carefully checked for possible dents or breaks in the metal to insure that all connections are "wrench tight," and that each part of the system being installed conforms with the design drawings.

To make certain that all pipes are open, a stream of air or water should be forced through all headers prior to embedding them, and again immediately after concrete placing has been completed. Vents at the top of each grouting lift require the same high standard of workmanship and supervision while being installed. During the placing of concrete, it is necessary to ascertain that the grout seals are not pushed out of line and against the contraction joint itself, that the pipe systems are not moved or loosened, and that the vents, such as grout grooves or grout outlets, are not plugged. The effectiveness and facility with which contraction joints are grouted is dependent largely on the quality of the workmanship and the degree of supervision employed throughout the construction period.

Contraction joints should be grouted as soon as the concrete has cooled the desired amount and the openings between clocks have reached their maximum. An effort should be made to complete contraction joint grouting during the normal construction program, prior to filling of the reservoir (usually a design requirement in the case of arch-type dams), and prior to final high-pressure curtain grouting under the dam. The progress of concrete cooling operations and the organization and vigorous prosecution of the construction schedule are the factors controlling the starting of contraction-joint grouting operations.



GROUT-PLANT installation consists of mixer, water meter, and tank in which agitator is mounted. Pump takes suction from agitator tank through hose connection in right foreground. Before entering agitator tank, grout passes through coarse wire screen to remove pieces of sacking, string, cement lumps and other debris.

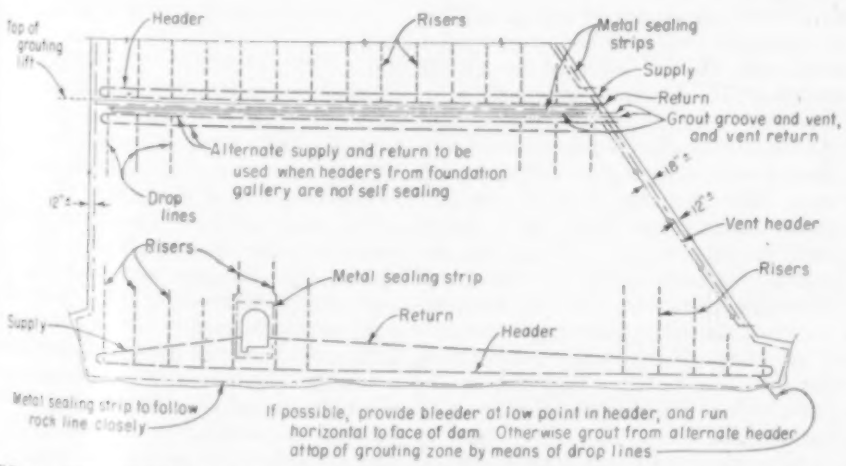

Top of grouting lift
Header
Risers
Metal sealing strips
Supply
Return
Grout groove and vent, and vent return
Alternate supply and return to be used when headers from foundation gallery are not self sealing
Drop lines
Vent header
Risers
Metal sealing strip
Return
Header
Supply
Metal sealing strip to follow rock line closely
If possible, provide bleeder at low point in header, and run horizontal to face of dam. Otherwise grout from alternate header at top of grouting zone by means of drop lines

FIG. 1. INSTALLATION for grouting contraction joint at base of dam with foundation gallery illustrates general principles followed in making grout-pipe layouts for contraction joints on large dams. Where there is no foundation gallery, header at rock surface is made self draining if possible by providing bleeders running horizontal to face of dam.

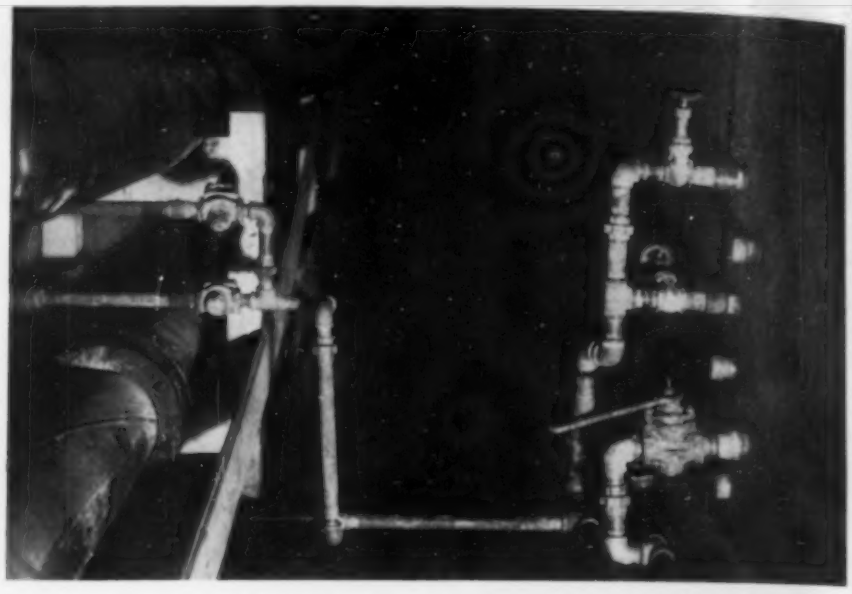
Preparation for Grouting

Good practice would be to start from the lowest bedrock of the foundation and grout to the same elevation from abutment to abutment. Filling of the joints, one after another, with specified quantities of grout could be continued until they were full to the top of all lifts at any particular elevation. If it were possible to follow such an ideal procedure, all tipping of the blocks and resulting high stresses could be eliminated; however, it is usually necessary to modify the best laid plans and fit the contraction-joint grouting program to the construction schedule.

Often joints, or lifts within a joint, cannot be grouted at the same time as the adjacent joints because the concrete blocks of the dam may be of varying heights, the grout pipe headers serving a lift of contraction joint may be plugged, or the grout groove vents or grout stops may be leaking.

To expedite grouting operations and to complete grouting of contraction joints in certain areas it may be necessary to temporarily bypass joints which are difficult to open up, wash out, and test. Contraction joints which for one reason or another cannot be grouted in normal sequence, can be protected from closing by filling them with water prior to

LEAK FROM CONTRACTION JOINT in gallery of dam shows up during water test prior to grouting. Leaks like this one are sealed before grouting starts.



PIPE for grouting contraction joints is installed in inspection gallery of dam. Grout headers and risers are of $1^1/_2$-in. diameter. Large headers and risers shown at left carry water for cooling concrete.

grouting of other joints in the vicinity. In addition, the presence of water in such joints minimizes movement of the adjacent blocks and reduces the danger of high compressive and tensile stresses within the blocks.

Experience has proved that it is seldom practical or economical to work more than one shift a day. Normally, grouting of contraction joints with a combined area of 100,000 sq ft and the cleanup work can be completed in an 8- or 9-hour day shift, when one grout pump, mixer, and agitator are used.

Grouting Equipment Described

The equipment necessary to adequately and effectively mix varying proportions of water and cement, and pump the mixture into the contraction joints is almost identical to that used in grouting foundations. The basic units for a grout plant consist of a grout pump, a mixing tank, and an agitator tank. The size of the equipment varies considerably and depends on the number and area of contraction joints to be grouted. An air-driven 10×3×10-in. grout pump and an air-driven mixer and agitator tank, each with a capacity of 20 cu ft, will grout about 100,000 sq ft of joint area in a day's time.

The pump must be capable of forcing grout into the contraction joints in a continuous, uninterrupted flow at any specified pressure. Several manufacturers make such pumps but most pumps on the market require some modification of the working parts (cylinder liners, pistons, valve seats, valves, piston-rods, and packing) to make them capable of pumping a highly abrasive grout mix without constant shutdowns for repairs. A grout pump in good condition will permit close control of pressures and a flexible rate of injection. Depending on the size of the pump, the design capacity will vary from 20 to 100 gpm when supplied with air pressure at 100 psi. Grout pumps should be handled only by experienced workmen, and on large jobs it is good insurance to provide an extra pump to prevent possible interruption of operations and loss of lines and joints.

A grout mixer consists of a cylindrical mixing chamber and a mixing mechanism made up of a propeller shaft and blades operated by an air motor. Grout mixers are made commercially or can be fabricated and assembled in local machine shops. Any mixer of ample capacity will serve the purpose if it thoroughly mixes cement and water, and has a suitable device for measuring the water. The quantity the mixer will hold is important as many contraction-joint zones require large amounts of cement. If the mixer is too small, the first few batches may set in the joint before additional grout can be pumped.

After the grout has been mixed, it passes to another cylindrical tank in which it is continuously agitated and from which it is pumped through pipelines into the contraction joint. The grout is agitated to prevent the suspended cement from settling to the bottom of the tank. The agitating tank contains a propellor shaft and blades, and is powered by an air motor.

Adequate equipment and the application of a carefully developed technique are essential in obtaining a successful job of contraction joint grouting. Because of the highly specialized nature of contraction joint grouting, intensive planning of all operations and detailed testing of all portions of the joint systems is extremely important. Once the flow of grout has been started into the contraction joints, it becomes impractical, time-consuming, and often costly to shut down the pump long enough to correct defects in planning or to secure additional equipment.

Much Preparatory Work Necessary

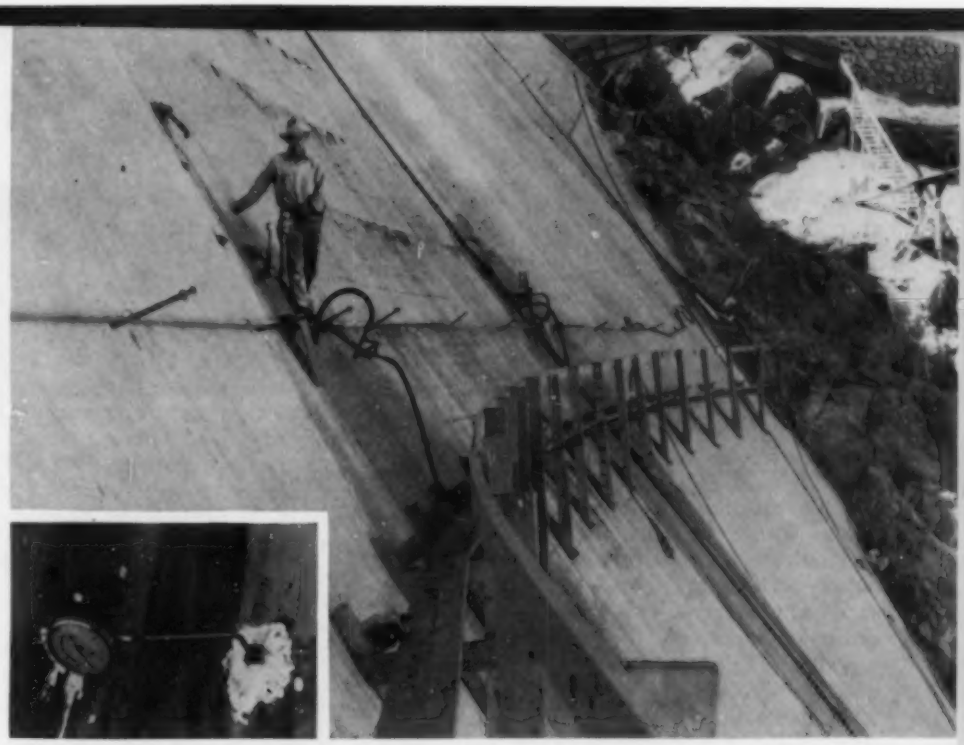
Before actual grouting operations can be started, a large amount of preparatory work is necessary. On most jobs it is advantageous to install two sets of temporary pipelines. One set consists of grout supply and return pipes leading from the grout plant to the set of joints to be grouted; the other set consists of pipes which supply air and water to the area in which the grouting is to be done. The two systems of pipes are simple to install in small dams; however, in large structures they may reach extensive proportions and become extremely complicated in layout. In general, the first prerequisite before grouting any set of contraction joints is to complete all pipefitting

necessary to inject grout into the supply headers, and to fill with water the joints adjacent to those scheduled for grouting.

In the larger concrete dams, a number of joints whose combined face area will not exceed 100,000 sq ft are grouped into a set or zone which can be grouted within an 8-hour period. As soon as the number of contraction joints to be grouted has been determined, the hookup and testing work is done. Communication facilities, such as telephones, signal lights, and buzzer systems must be installed from the grout plant to strategic locations in the galleries, to the faces of the dam, and elsewhere as required. Dial gages to measure opening and closing of contraction joints during grouting must be located and installed across the contraction joints.

Piping systems and contraction joints must be tested with air and water prior to grouting to ascertain that they are open and clean. The test is made by forcing water and compressed air through the system and into the joints until the return flow from the vent headers appears clean. During the test, all headers are carefully checked to determine that they are open and that the system is functioning in a satisfactory manner. When flushing and testing of the contraction joints has been completed, the joints to be grouted are filled with water and pressure is applied to ascertain the location, size, and extent of leaks through the grout stops or concrete. The testing should be done the day before grouting so that sufficient time will be available for any necessary calking. Washing the contraction joints and filling them with water not only cleans the joints and exposes possible leaks, but also lubricates the joints so that they can be more easily filled with grout.

Water is injected into contraction joints adjacent to those being grouted to provide a protective curtain to balance the thrust of the grout pressure against the nearby blocks. Provisions should be made during the layout of temporary pipe systems for pumping water into the lifts of the joints directly above those being grouted as soon as grout flows from the vent of the lift being grouted. By opening the valves on the supply pipe of the lift above and observing the escaping water for cement color, a check can be made for grout that may be leaking past the horizontal sealing strip. The weight of the water will exert a counterbalancing pressure on the horizontal sealing strips and reduce the probability of grout leaks. A "springing effect" is produced on the contraction joint by the weight of the water, which tends to force the joint open and to give a more effective spread of grout in the lift being grouted.



PIPELINES ON DOWNSTREAM FACE of dam carry grout for sealing contraction joints. Dial gages, set across all joints, are provided with suitable shelters to protect them from changes in air temperature, falling debris, and careless workmen. Apparatus used by Bureau of Reclamation to measure opening and closing of joints during grouting utilizes jewel-bearing dial gages designed to register deflection of 0.0001 in.

In grouting contraction joints, the type of cement used is of great importance. Several types of cements have been successfully used; namely, normal, modified, and low-heat portland cements, and oil-well grouting cements. To be suitable for grouting contraction joints, a cement should be of such fineness that it will pass small joint openings, be free from impurities, and be sufficiently slow setting so that the contraction joints will be completely filled before the cement settles from the mix and plugs the supply and return headers. The use of low-heat or modified cement will greatly reduce the danger of such plugging.

The Bureau of Reclamation specifies that cement for contraction-joint grouting "shall be of such fineness that 100 percent will pass a No. 100 United States Standard screen, and 98 percent will pass a No. 200 United States Standard screen." Included in the plans for grouting each set or zone of contraction joints is an estimate of the cement required, so that any necessary reprocessing can be completed before grouting is started.

Start Grouting Early in Day

Grouting is started in the morning, at the beginning of the regular day shift, so that the pumping of grout can be completed shortly after midday unless unforeseen difficulties are encountered. Sufficient time must be allowed after completion of grouting for cleaning grout pumps, grout lines, and contraction joint systems into which grout may have leaked.

After the grout pump has been started, the pipelines are filled with the starting mixture, and everything is ready for the injection of grout into the first contraction joint. The grout mixture is pumped, one batch at a time. Each batch contains from one to five sacks of cement, depending on the area of the individual contraction joints. No sand and no admixtures are used. For the initial batches in each joint, a thin mixture of 2:1 grout (water-cement ratio by volume) has proved to be the best. The thin grout serves as a lubricant for the lower portions of each contraction joint. The first few batches of thin grout are followed by a 1:1 mixture.

By pumping a predetermined quantity of grout into each joint and by rotating the grout supply from joint to joint in established sequence, sufficient time is allowed for the grout to settle in each joint, thus maintaining the grout level at about the same elevation throughout the zone. During the grout injection cycles, the contraction joints with small areas that will fill rapidly are temporarily bypassed. When grouting contraction joints with exceptionally large areas, it often becomes necessary to increase the speed of the pump to prevent the piping systems and contraction joints from becoming plugged.

It is usually possible to thicken the 1:1 mix to an 0.8:1 mix after the joints are approximately 75 percent full. By using a thicker grout to

complete grouting of a lift of contraction joints, the runoff water at the top of the lift is reduced, and the joint is filled with a denser mixture. Vent headers should be opened at regular intervals so that air, excess water, and thin grout can escape from the joint.

Various Factors Determine Pressure Used

The dimensions of the blocks of concrete in the dam, the design of the dam, over-all height, width of contraction-joint openings, and unforeseen difficulties such as plugged supply or vent headers and abnormal expansion or contraction of the concrete, determine to a large extent the amount of pressure that should be used in grouting. The maximum allowable grout pressure is that pressure which the concrete block will withstand before deflecting excessively and creating undesirable tensile and shearing stresses at the horizontal construction joints.

The maximum allowable pressure at the top of a 50-ft grouting lift may range from 25 to 60 psi. A pressure gage attached to the vent header at the top of each grouting lift is used to measure pressures in the contraction joints.

A flow of grout almost as thick as that being pumped, should be obtained from the vent at the top of the lift before the maximum allowable pressures are applied. The stopcock valve on the vent header is closed as soon as heavy grout issues from the header. Pumping of grout into the joint is continued until the gage at the vent header records the predetermined maximum pressure. When this pressure has been reached, the valve on the supply header is closed and the pressure maintained on the grout in the joint. Because a small amount of water is constantly being squeezed out of the grout mixture into the pores of the adjacent concrete blocks, the pressure recorded at the vent header will begin to drop. Each decrease in pressure is followed by injections of grout. When the contraction joint will hold the grout pressure for about 30 minutes without an appreciable pressure loss, grouting of the joint can be considered complete.

Treatment of Grout Leaks

Occasionally serious leaks, not discovered during washing and testing operations, will develop during grouting, making it difficult or impossible to maintain pressure on a contraction joint. When such uncontrollable leaks develop, it is often possible to regrout the affected joint through the vent header piping system.

Because of faulty or careless installation during construction, grout seals frequently permit grout to travel from an area being grouted into an ungrouted area.

Leakage of grout into an ungrouted contraction joint must be prevented or the joint will become plugged and rendered useless for future operations. Prior to grouting, contraction joints adjacent to the area being grouted will have been filled with water which acts as a cushion in preventing possible deflection, and as an aid in keeping the piping systems open if grout leaks should occur.

The contraction-joint systems immediately above those being grouted are filled with water as soon as grout returns are observed from the vent headers of the system being grouted. The bottom supply headers of the joint systems above should be opened periodically to check for grout leaks coming through or around the horizontal grout stops. Any grout leaking into an ungrouted lift or joint should be washed out before it sets and destroys the usefulness of the contraction joint. Most grout leaks are caused by defective metal sealing strips. However, large cracks are sometimes present and permit extensive leakage through the concrete at some distance from grout stops.

Measurements of variations in width of contraction-joint openings should be made continually during grouting. When grouting the contraction joints of arch dams, measurements of the deflection of the structure at the crown cantilever section should be made, and changes in width of contraction-joint openings for all transverse and longitudinal joints should be recorded.

Some deflection of contraction joints almost invariably accompanies contraction-joint grouting, especially when pressure is applied. The amount of deflection permissible in the blocks of a dam depends largely on the size of the blocks. Normally a contraction joint subjected to pressure should not increase in width more than 0.02 in. at the top of a 50-ft lift or joint; otherwise undesirable stresses may develop.

Measurements should be made either in the galleries or at the faces of the dam, but always near the top of the lift being grouted. Dial gages are also mounted across all adjacent waterfilled joints. If galleries are present in the dam and can be utilized, they provide a location that is not only safe but also comparatively free from large temperature variations. To serve the purpose for which they are intended, that is, to detect possible movement of the blocks during grouting, dial gages or any other measuring devices must be properly installed, must be accurate, and must be watched closely. It is good procedure to record the gage readings each time a batch of grout is injected into a contraction joint.

Prompt Cleanup Is Important

As stated previously, the value of planning cannot be overemphasized, and in that planning a definite period of time should be set aside for performing the necessary cleanup tasks. The cleanup which normally concludes a day's work is as important as the actual pumping of grout. Cement which has settled out in the mixers, agitators, pipelines, valves, and pumps should be removed as soon as possible after grouting. Grout which has been spilled in galleries, gutters, shafts, or on the faces of the structure, should be washed off before unsightly discoloration occurs.

In addition to cleaning of equipment, temporary pipe and fittings, and concrete surfaces, ungrouted joints into which grout may have leaked should be flushed and washed clean. Common washing procedure is to fill and drain each contraction joint into which grout may have leaked until a clear return flow of water is obtained. Washing of such joints is usually started about 30 minutes after the grouting has been completed, or after such time as may be required for the grout to attain its initial set. Joints adjacent to those grouted, which have been filled with water to balance grouting pressures, should not be drained until the grout in the grouted joints has begun to set.

The day following the completion of grouting on a set or zone of contraction joints is utilized to clean valves and to break down, move, and reassemble temporary piping and communication equipment in preparation for grouting the next zone of contraction joints. Ordinarily on large dams two days are expended between the time when one set of contraction joints is grouted and when the next set is hooked up, flushed out, tested under pressure, and all equipment pronounced ready for grouting.

Number of joints in each hookup, size and condition of equipment, size of dam, distance between grout plant and contraction joints to be grouted, availability of experienced labor, and time available to complete the grouting program—all these factors influence the preliminary planning and the speed and coordination with which different tasks are performed.

Engineers' Notebook

Formulas Facilitate Design of Ring-Girder-Supported Pipes

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RING girders have been used rather extensively during the past fifteen years for the support of large steel pipe in pipelines or penstocks. It is believed that the formulas given in this article will be found useful in various applications of this type of construction. These formulas were originally developed by the writer in connection with the design of the penstock for the North Platte (Nebr.) power plant of the Platte Valley Public Power and Irrigation District. A comparison was worked out between a design with supports on the horizontal axis and one with supports below the axis, the former being adopted for actual construction.

These formulas were recently used in the design of a large steel cylinder forming the exterior portion of a subaqueous tunnel constructed by the trench method with precast sections. In constructing the cylinder, temporary supports were provided which reacted against the ring girders attached to the cylinders. The ring girders were investigated for supports located either at the horizontal axis or at angles of 120 or 150 deg from the vertical axis.

In 1933, Herman Schorer, M. ASCE, presented detailed methods for analyzing the stresses in a thin-walled pipe with spans of considerable length, and stiffened by circumferential girders at the supports ("Design of Large Pipe Lines," TRANSACTIONS of ASCE, Vol. 98 (1933), p. 101). In Mr. Schorer's article, the pipe is assumed to be horizontal and supported by vertical reactions at two points on the horizontal axis. In the present article, formulas are presented for computing the moments and stresses in the ring girder when the pipe is supported by vertical reactions applied at points which are below the horizontal axis. In a subsequent article, formulas will be given for computing moments and stresses in the ring girder when the pipe is supported at points on the horizontal axis, but subject to transverse forces produced by horizontal acceleration from an earthquake.

In the following discussion tension is considered as a positive force, compression as negative. Moment is positive when it produces tension on the outside of the ring. Following the method of analysis of Schorer, the external forces acting on the ring girder are as shown in Fig. 1. The ring is assumed to be cut at the top, and the left side of the ring is held in position by the forces X_1 and Y_1, and by the moment M_1, all applied at the axis of the pipe. As shown by Schorer (Eq. 37):

$$S = \frac{Q \sin V}{\pi r}$$

in which

Q = total load transmitted by shear to one ring girder

S = shear between pipe shell and ring, per unit width of circumference

M_s = moment of external forces between 0 and D, with respect to D. Schorer shows (Eq. 41) that M_s, the value of M_e due to the shearing forces, equals

$$M_s = \frac{QR}{\pi}\left[\frac{U}{2}\sin U - \frac{r}{R}(1 - \cos U)\right]$$

By symmetry, $Y_1 = 0$

Following a procedure similar to Schorer's, the following results may be obtained:

$$X_1 = \frac{Q}{\pi}\left(\frac{r}{R} - \frac{a'}{R}\sin U_p - \frac{1}{4} + \frac{1}{2}\sin^2 U_p\right) \quad \ldots (1)$$

$$M_e = \frac{QR}{\pi}\left[\frac{r}{R} - \frac{a'}{R}(\pi/2 - U_p/2) + \frac{1}{2}\cos U_p\right] \quad \ldots (2)$$

The moment at the top of the ring is

$$M_0 = \frac{QR}{\pi}\left[\frac{1}{4} - \frac{1}{2}\sin^2 U_p + \frac{a'}{R}(\sin U_p - \pi/2 + U_p/2) + \frac{1}{2}\cos U_p\right] \quad \ldots (3)$$

The normal stress on a section at the top is

$$N_0 = X_1 \quad \ldots (4)$$

For any section above the support (from $U = 0$ to $U = U_p$) the moment is M_1 and the normal stress, N_1.

$$M_1 = M_0 + N_0 R(1 - \cos U) + M_s \quad \ldots (5)$$

in which M_s is computed by Schorer's Eq. 41.

$$N_1 = N_0 \cos U - \frac{QU \sin U}{2\pi} \quad \ldots (6)$$

For any section below the support (from $U = U_p$ to $U = \pi$), the moment is M_2 and the normal stress N_2.

$$M_2 = M_1 + \frac{QR}{2}(a'/R - \sin U) \quad \ldots (7)$$

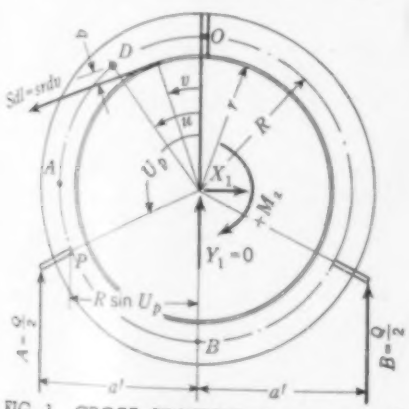


FIG. 1. CROSS SECTION shows external forces acting on ring girder, which supports steel pipeline and is supported at points below horizontal axis. For purposes of analysis, ring is assumed to be cut at top.

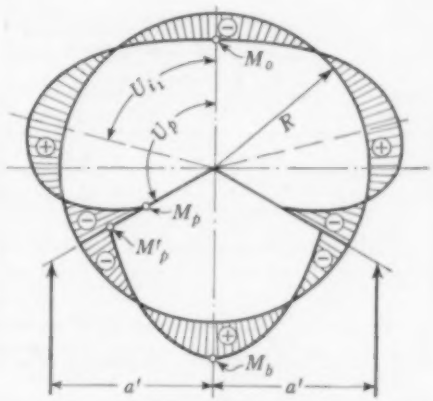


FIG. 2. CROSS SECTION shows distribution of positive and negative moments on ring girder supported at points below horizontal axis.

in which M_1 is computed by Eq. 5.

$$N_2 = N_0 \cos U + \frac{Q \sin U}{2}\left(1 - U/\pi\right) \ldots (8)$$

The moment just above the support is M_p.

$$M_p = M_0 + N_0 R\left(1 - \cos U_p\right) + M_s \ldots (9)$$

in which M_s is computed from Schorer's Eq. 41, with $U = U_p$.

The moment just below the support is M_p'.

$$M_p' = M_p + \frac{QR}{2}\left(a'/R - \sin U_p\right) \ldots (10)$$

The moment at the bottom of the ring-girder is M_b.

$$M_b = M_1 - \frac{Qa'}{2} \ldots (11)$$

in which M_1 is computed from Eq. 5, with $U = \pi$.

The value of M_1 can be shown to vary from a maximum negative value (M_0) at the top of the ring, through zero to a maximum positive value at an angle of U_{i1}, and again passing through zero and increasing to a maximum negative value (M_p) at the support. The value of the moments in the ring will vary as shown in Fig. 2.

The value of U_{i1} can be obtained by solving the following equation:

$$U_{i1} \cot U_{i1} = \frac{2a' \sin U_p}{R} - \sin^2 U_p - \frac{1}{2} \ldots (12)$$

This value of U_{i1} can be substituted in Eq. 5 to obtain the intermediate maximum value of M_1, or M_{i1}.

The intermediate maximum moment below the support, or M_{i2}, is located at the angle

$$U_{i2} = \pi - U_{i1} \ldots (13)$$

When U_{i2} (or $\pi - U_{i1}$) is less than U_p, the intermediate maximum moment below the support disappears, as shown in Fig. 2.

Chart Determines Constants for Gabled Beams in Reinforced Concrete Design

ARTHUR F. LIEBSCHER, Assoc. M. ASCE

Department of Public Works, State of California, Sacramento

GABLED BEAMS are occasionally encountered in reinforced concrete design where continuity is to be considered. Since there seemed to be no chart readily available to determine the beam constants, construction of the adjacent diagrams, Fig. 1, was undertaken.

While the shape and loading possibilities are limited to symmetrical conditions, it is believed that where unsymmetrical loadings are encountered the diagrams will serve to guide the user in selecting approximate coefficients which are, often, sufficiently accurate. Moment coefficients are for a concentrated load at the center of the span, or for a uniform load, no account being taken of the variable weight of the beam stem. Stiffness factors are for use in the equation $K = kEI/l$, where $k = 4$ for prismatic beams and I is the moment of inertia at the minimum depth, d_1. The carryover factor C has its usual value of 0.5 where $d_1 = d_2$.

Figure 2 shows a gabled beam included in a rigid frame and carrying, perhaps, a monorail and hoist at midspan. The ratio, $d_1/d_2 = 0.57$, immediately indicates, as shown, the desired coefficients. The fixed-end moment is then $0.0647 \times 890 \times 16^2 + 0.0905 \times 7{,}000 \times 16 = 24{,}900$ ft-lb, and the stiffness,

$$K = \frac{6.9 \times 7.5 \times 16^3 \times 2}{12 \times 16} = 2{,}210$$

The factor "2" in the calculations is an empirical coefficient to express I for a T-beam section in terms of I for a rectangular section. The modulus of elasticity, E, is herein considered constant and is omitted from the calculations, since only relative values of K are required. Similarly for the left beam,

$$K = \frac{4 \times 7.5 \times 16^3 \times 2}{12 \times 18} = 1{,}140$$

and for the column,

$$K = \frac{3 \times 12 \times 12^3}{12 \times 7} = 740$$

The suggestions and checking of R. R. Alvy, Jun. ASCE, in making up this chart are acknowledged.

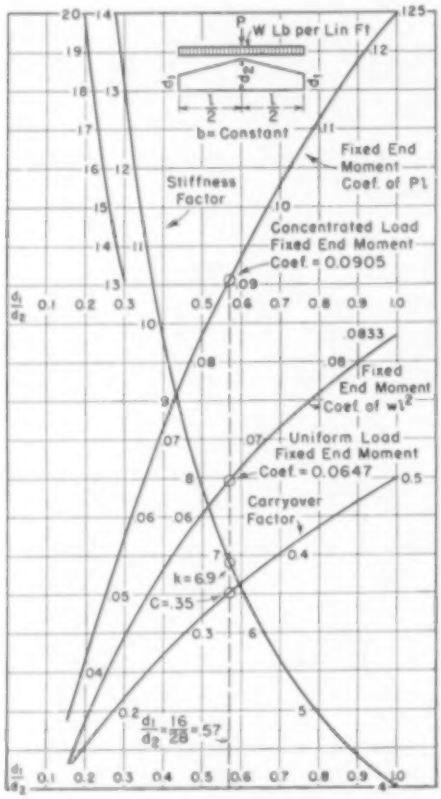


FIG. 1. DIAGRAMS DETERMINE fixed-end moment coefficients and carryover and stiffness factors for gabled beams. Readings are taken along vertical dashed line. Ratio, $d_1/d_2 = 0.57$, leads to desired coefficients.

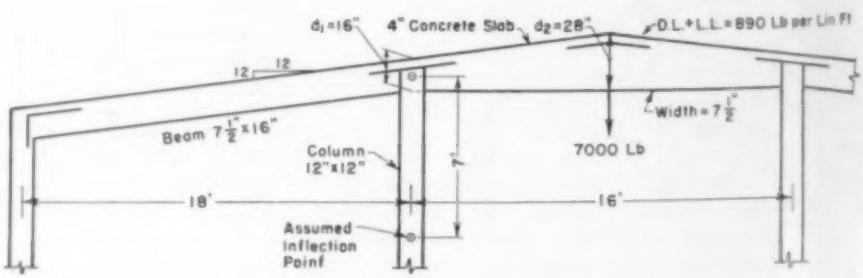


FIG. 2. GABLED BEAM included in rigid frame illustrates use of Fig. 1. Beam carries concentrated load of 7,000 lb at midspan and uniform dead plus live load of 890 lb per lin ft.

SOCIETY NEWS

Outstanding Program Is Arranged for ASCE Fall Meeting

AN UNUSUAL PROGRAM of technical and professional talks, inspection trips, and social events is being arranged for the edification and pleasure of members attending the ASCE Fall Meeting in Washington by a group of hard-working committees headed by A. N. Carter. Special entertainment for the ladies, which is being planned by committees under the chairmanship of Mrs. Gail A. Hathaway, will include a reception and tours of the Washington embassies and historic and picturesque Georgetown.

Distinguished Speakers Will Be Heard

Though the meeting program is printed elsewhere in the issue, certain highlights will bear emphasis by repetition. As is to be expected of a meeting scheduled in Washington, a galaxy of notable speakers will be heard. Among these are Brig. Gen. Gordon R. Young, engineer commissioner of the District of Columbia, who will give the address of welcome at the opening session on Wednesday morning, November 2; Gen. Lucius D. Clay, commanding general of the U. S. Military Government in Germany until his recent retirement from active service, who will deliver the principal talk at the opening session; and Paul G. Hoffman, administrator of the Economic Cooperation Administration, who is scheduled to address the Wednesday noon luncheon at the Statler.

During the Wednesday afternoon session Dwight W. Winkelman, past-president of the Associated General Contractors of America, will report on the work of the Joint Cooperative Committee of the ASCE and AGC, which has completed its first year of work; Paul Wooten, nationally known columnist, will discuss the role of the civil engineer in federal service; and Maj. Gen. U. S. Grant, III, chairman emeritus of the National Capital Park and Planning Commission, will speak on "Planning the National Capital—General Objectives and Problems in Attainment." This program will be followed by an inspection of the White House renovation project, provided the work of reconstruction will permit inspection at that time.

Ten Technical Divisions to Schedule Sessions

Thursday will be devoted to sessions of ten Technical Divisions covering a variety of subjects of national and international importance. The Construction Division has scheduled a talk by Willard L. Thorp, Assistant Secretary of State, on the President's Four-Point Program for supplying technical assistance and know-how to backward nations. Technical research in the construction industry, particularly as it pertains to the building field, will also be discussed at this session. Another prominent Thursday speaker will be Dr. Karl T. Compton, chairman of the Research and Development Board of the National Military Establishment, who will address the general luncheon.

Construction Projects Under Way

Members attending the Fall Meeting will be able to view a number of interesting engineering projects in an advanced state of construction. The Dupont Circle Underpass, carrying busy Connecticut Avenue underneath other main thoroughfares, will be within a few months of completion. The K Street Elevated Highway connecting with the Key Bridge across the Potomac, the new South Capitol Street Bridge across the Anacostia River, and the new highway bridge carrying Route 1 over the Potomac and constituting important links to Maryland and Virginia, are other outstanding structures nearing completion. There are also several public buildings of considerable interest, either now under way or completed since many members last visited the nation's capital.

Local Section and Student Conferences Arranged

Delegates from 26 Sections in the eastern part of the country will take part in the Local Section Conference, to be held on Monday and Tuesday preceding the Fall Meeting. The student conference, arranged for Tuesday, will include four major inspection trips during the day and a meeting with Society officers in the evening. Students in engineering colleges as far away as Massachusetts and Ohio have already indicated that they plan to attend.

Post-Convention Excursion

For the two days following the Fall Convention, a special 400-mile trip along the Skyline Drive to Charlottesville, Richmond, and Williamsburg, Va., is being planned. This trip will be by private motor coach, leaving the Statler Hotel on the morning of November 5 and returning there during the late afternoon of November 6. The excursion will include visits to the campus of the University of Virginia and to Monticello, the home of Thomas Jefferson, and a tour of Williamsburg, early center of colonial culture and a former capital of the Virginia Colony. More than 300 colonial buildings have been carefully restored to their prime, and some of the most famous of these will be visited. Inquiries regarding

HOTEL STATLER, HEADQUARTERS FOR ASCE FALL MEETING in Washington, D. C., provides accommodations for technical sessions as well as luncheons and dinner dance. Location of hotel, just three blocks from the White House, is convenient to government buildings and other points of interest.

the tour should be addressed to Ralph L. Preble, convention manager, United States Travel Agency, 807 15th Street, N.W. Washington 5, D.C.

Early Registration Imperative

Members are reminded that October 12 will be the deadline for registering for accommodations at the Statler Hotel, meeting headquarters, and that earlier registration is advisable. For convenience in registering, a blank has been provided for the purpose on page 93 of this issue.

Membership Listing to Be Issued by Society

PUBLICATION OF AN ASCE membership list, to be distributed in January 1950, has been authorized by the Board of Direction in place of a Yearbook. Since no membership listing has been issued since 1947, members are urged to return the cards requesting information about themselves which were mailed early in July, if they have not already done so. Deadline for return of the cards is September 30. For the convenience of members who have misplaced their cards, the duplicate form, on page 86 of this issue, may be filled in and mailed to Society Headquarters.

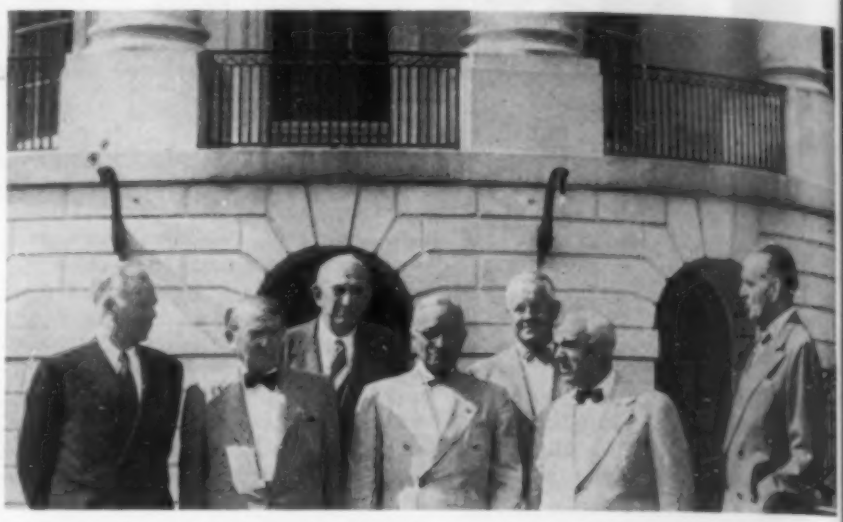
Supplementing the membership list, an official register of committee memberships, including a directory of officers, will be distributed in 1950.

Daniel W. Mead Prize Competition Announced

AT THE MEXICO CITY meeting of the Board of Direction, the ASCE Committee on Professional Conduct announced a new competition for the Daniel W. Mead Prizes for Junior and Student Chapter members. This year the subject is, "The Junior Engineer's Idea of His Employer's Ethical Responsibility to Him." All papers for entry in the competition must be in the hands of the Executive Secretary of the Society by June 1, 1950. Copies of the rules for contestants may be obtained from Society Headquarters, 33 West 39th Street, New York 18, N.Y.

Established and endowed in 1939 by the late Daniel W. Mead, Past-President and Honorary Member of ASCE, the Daniel W. Mead Awards consist of a Junior prize of $50 in cash and a certificate, and a Student prize of $25 and a certificate.

Members of White House Renovation Commission Discuss Project with President Truman



GROUPED ABOUT PRESIDENT TRUMAN ON WHITE HOUSE LAWN are members of newly appointed White House Renovation Commission. Shown, left to right, are Senator Edward Martin, Pennsylvania; Senator Kenneth McKellar, Tennessee; Richard E. Dougherty, Past-President of ASCE and consultant to New York Central Railroad; the President; Douglass Orr, past-president of American Institute of Architects; and Representatives Louis C. Rabaut, Michigan, and Frank B. Keefe, Wisconsin. Maj. Gen. Glen E. Edgerton, M.ASCE, is executive director of Commission, and ASCE President-elect Ernest E. Howard, Emil H. Praeger, M. ASCE, and William A. Delano are consultants to it.

ECPD Program Improves Status of Engineering

NOTABLE AMONG ORGANIZATIONS working for unification and strengthening of the engineering profession is the Engineers Council for Professional Development, a cooperating agency for eight national engineering societies. These organizations, in addition to the four Founder Societies, are the Engineering Institute of Canada, the American Society for Engineering Education, the American Institute of Chemical Engineers, and the National Council of State Boards of Engineering Examiners. Not an independent body, ECPD depends upon its sponsoring organizations for financial support and for its administrative personnel. Its functions are promotional and exploratory, and its responsibility is the professional welfare of the individual engineer, regardless of his field of technical specialization.

ECPD Organized in 1932

Organized by the major engineering societies in October 1932, ECPD was an outgrowth of the depression, which aroused engineers to compare the economic and professional status of engineering with that of the other established professions. Thoughtful members of the profession began to realize the need for a joint program for "upbuilding engineering as a profession" and establishing recognized methods of certification.

The governing body of ECPD is a council composed of 24 members, three from each sponsoring organization, and four ex-officio members representing the four main ECPD committees: Student Selection and Guidance, Engineering Schools, Professional Training, and Professional Recognition. In addition to these four standing committees, which cover all stages of the individual's professional growth, there are two special committees—one on Information [which has prepared this statement] and the other on Principles of Engineering Ethics. Functioning as an exploratory agency, ECPD seeks to solve professional questions and makes recommendations to the governing boards of the sponsoring organizations, which administer recommended procedures through their own national and local groups.

Contributions in Field of Student Guidance Important

In the field of student selection and guidance and engineering schools, ECPD has achieved notable success. Its Committee on Student Selection and Guidance has created two widely used aptitude tests as an aid to students considering careers in engineering. In 1947–1948 more than 20,000 students took these tests. In 1948 administration of the tests was turned over to the newly organized Educational Testing Service, with headquarters at Princeton University. The com-

mittee's booklet, "Engineering as a Career," has sold more than 60,000 copies, and posters on the same topic have been distributed among 5,000 high schools.

Many Engineering Curricula Accredited

Perhaps the most conspicuous of ECPD's accomplishments is its program of accrediting engineering curriculs, which is conducted by its Committee on Engineering Schools. As of October 1948, some 688 curricula had been inspected, evaluated, and accredited at 143 of the 167 institutions in the United States that grant engineering degrees; 86 curricula had been examined but not accredited; and 23 curricula had been accredited at 13 technical institutes in an initial extension of the accrediting program.

ECPD achievements in the field of professional training and professional recognition are more difficult to evaluate. However, it can be said that, as a result of the ECPD program, more engineering schools are sponsoring evening classes on the graduate level and more graduate engineers are finding it possible to continue their engineering studies while making the adjustments imposed by having a job. The ECPD program has also won the support of many employers of engineers who are assuming responsibility for the professional education of their staff engineers.

In the field of professional recognition, ECPD has had the task of establishing recognized measures of performance to serve as certification of full professional status. Membership in a professional society and a license to practice engineering are current criteria, but before these criteria can be fully effective much must be done to establish definitions and standardize membership grades and state engineering registration laws.

ECPD Is a Unifying Agency

By focusing the thinking of engineering societies on matters of common professional concern, ECPD has been setting the stage for eventual unification of the engineering profession. It has provided opportunity for leaders of the various branches of engineering to work together. This experience in cooperation is contributing to the success of Engineers Joint Council, the medium through which the Founder Societies and the American Institute of Chemical Engineers work together on matters of economic import for engineers. Where ECPD is concerned with the individual welfare of engineers, EJC is organized to represent the engineering profession in matters concerning its sister professions, international relations, and government agencies.

Ways in which the individual engineer can aid in the ECPD program include helping to organize a local ECPD Student Guidance Committee to cooperate with high school authorities in the job of helping young men select a career and organizing ECPD groups to study training programs, exchange of facilities and engineering registration laws with the objective of making them more uniform.

Guides and Manuals Available

An order blank to facilitate purchase of ECPD manuals and pamphlets, which have been found widely helpful in student guidance and other work, will be found on page 103 of the advertising section.

UNESCO Mobilizes World's Conservation Experts

ASCE OFFICIALLY PARTICIPATED in the first world conservation conference of its kind ever held through its membership in Engineers Joint Council. Several hundred engineers, scientists, economists, and other experts from more than 40 United Nations countries have been meeting for the past two weeks at Lake Success, in a UNESCO-guided Scientific Conference on the Conservation and Utilization of Resources. The conference opened on August 17 with an address of welcome on behalf of the President of the United States by Interior Secretary J. A. Krug.

To facilitate maximum exchange of experiences and ideas for making best use of the world's natural resources, the conference was divided into separate sessions on water, land, forests, fuels, minerals, and wild life, with daily plenary sessions. The primary concern of the conference has been with the practical application of science to the management of resources for human use. It limited its tasks to an exchange of experiences on the techniques of conservation and utilization of resources.

Many members of ASCE contributed to the success of the conference, especially by leading various sessions related to the many facets of the use and control of water and by contributing papers on them.

Open house for delegates was held in the Engineering Societies Building on August 31.

CONSERVATION EXPERTS DISCUSS UTILIZATION OF WORLD'S RESOURCES at one of opening sessions of United Nations Conservation Conference. Shown in left-hand photo are (left to right) S. B. Morris, chief engineer, Los Angeles Department of Water and Power; Gordon L. Williams and Brig. Gen. J. H. Stratton, hydraulic engineer and partner in Knappen Tippetts Abbett Engineering Co., of New York; and C. G. Paulsen, chief hydraulic engineer, U.S. Geological Survey, Washington, D.C. All are ASCE members. In photo at right Gail Hathaway (second from right), special assistant to Chief of Engineers, Washington, D.C., and chairman of session on Appraisal of Water Resources, discusses a paper with participants. Left to right are Dr. Vincent J. Schaefer, General Electric Research Laboratory on making rain; K. N. Kathpala, M. ASCE, superintending engineer for irrigation in United Provinces of India; Mr. Hathaway; and Dr. Stevenson Buchan, H. M. Geological Survey, London.

James W. Rickey Gold Medal Awaits Its First Award

FIRST AWARD OF the James W. Rickey Medal, authorized by the Board of Direction in 1947, will probably be made in the current year. Established by Mrs. Rickey through the donation of a capital fund, the medal is intended to encourage and stimulate worth-while studies in the hydroelectric field, to which Mr. Rickey devoted his long and successful career.

Papers in the Society TRANSACTIONS are to be canvassed yearly for winners of this award, the recipient to be an author, or possibly joint authors, of "a paper in the general field of hydroelectric engineering, including any of its branches, that is deemed to constitute an outstanding contribution to the art. Both the value or usefulness of the subject matter as well as the form of presentation is taken into consideration."

The design of the solid gold metal is shown in the accompanying illustration, which is only slightly smaller than the original. On the obverse is a portrait bust of Mr. Rickey, with the identifying title, and on the reverse a depiction of an arch dam with the spillway operating, and a statement of the purpose of the medal, "To promote the art of hydroelectric engineering—for an outstanding presentation in the Society's TRANSACTIONS."

Appropriately, the dam depicted on the medal is Cheoah Dam on the Little Tennessee River, which is one of Mr. Rickey's principal engineering achievements.

JAMES W. RICKEY GOLD MEDAL, shown here in both obverse and reverse, commemorates engineering accomplishments of James W. Rickey, M. ASCE, chief hydraulic engineer for Aluminum Company of America, who died in 1943. Sculpture of medal is work of Miss Margaret Grigor, of Elmont, N.Y.

Tellers Canvass First Ballot for 1950 ASCE Officers

August 1, 1949

To the Secretary
American Society of Civil Engineers:

The tellers appointed to canvass the First Ballot for Official Nominees report as follows:

For Vice-President, Zone I

Albert Haertlein	276
Scattering	347
Void	1
Blank	7
Total	631

For Vice-President, Zone IV

Fred C. Scobey	1,116
*Julian Hinds	109
*Sidney T. Harding	91
Scattering	241
Void	0
Blank	12
Total	1,569

For Director, District 3

Carey Brown	31
Otto Holden	20
Scattering	13
†Ineligible Candidate	5
Void	0
Blank	2
Total	71

For Director, District 5

Frank L. Weaver	150
Charles D. Curtiss	116
Scattering	16
Void	0
Blank	1
Total	283

For Director, District 7

Gordon H. Butler	278
Scattering	26
Void	0
Blank	0
Total	304

For Director, District 8

Louis R. Howson	238
Scattering	25
†Ineligible Candidate	24
Void	0
Blank	0
Total	287

For Director, District 9

G. Brooks Earnest	201
Scattering	60
Void	0
Blank	3
Total	264

For Director, District 12

Walter J. Ryan	227
Scattering	29
Void	0
Blank	6
Total	262

For Director, District 16

George W. Lamb	315
Francis M. Dawson	259
Scattering	20
Void	0
Blank	0
Total	594

Ballots canvassed	4,265
Ballots withheld from canvass:	
Without signature	16
Total number of ballots received	4,281

Respectfully submitted,
EDWARD N. WHITNEY, *Chairman*
M. KOFMAN, *Vice-Chairman*

Charles C. Bonin	R. Edward Kuhn
George S. Bingham	Richard Q. Praeger
John J. Dwyer	John H. Stamataky
Robert R. Heins	Gerald T. McCarthy
Reuben Kosches	Edward L. Winslow, Jr.
Thomas K. Kuesel	

*** These candidates have withdrawn their names from the Second Ballot.**

† These votes were cast for incumbent officers who are presently ineligible for reelection in accordance with Section 5, Article V, of the Constitution.

NOTES FROM THE *Capital*

Joseph H. Ehlers, M. ASCE
Field Representative, ASCE

AS REPORTED LAST month, the Bureau of Public Roads, or Public Roads Administration as it was known under the Federal Works Agency when Reorganization Plan No. 7 was transmitted, was ordered transferred to the Commerce Department. The 60 days required for the plan to become effective ended on August 19. On the 58th day, the matter came up in the Senate, the debate being largely on the legality of the plan rather than on its merits. Opponents of the transfer of the Bureau of Public Roads to the Commerce Department lacked nine votes of being able to reject the President's proposal for transfer, and Public Roads is now a Bureau of the Department of Commerce.

The Hoover Commission has recommended that other elements of a transportation organization be transferred to the Commerce Department. While functionally the work of the Bureau is 90 percent an engineering job, including engineering economics, rather than a transportation job, there is little doubt that this Bureau in its new environment will maintain its semi-independent status and that our highways will continue to be developed as before.

Army Reorganization Proposed

In the proposed Army Organization Act of 1949 (S. 2334 and H.R. 5794), the Corps of Engineers could be abolished or consolidated with other branches at the convenience of the Executive Department at any time. Its statutory support is removed and the Corps of Engineers would remain only at the discretion of appointed officials. Both ASCE and Engineers Joint Council have requested that they be heard in this matter whenever hearings are scheduled.

Alaska Public Works Act Passed

The Alaska Public Works Act (S. 855) has passed both the Senate and the House and should soon become law. It authorizes the appropriation of $70,000,000 for aiding in the construction of local public works in Alaska. In effect, it involves grants-in-aid.

The federal government will let contracts for the project and after completion the projects will be sold to local public bodies so as to recover from 25 to 75 percent of the cost with a required average of 50 percent for the whole program. It is expected that an appropriation of $2,000,000 for the fiscal year with an additional $8,000,000 in contract authorizations will be requested.

Science, Advance Planning, and Civil Service Bills Held in Committee

The bill providing for the establishment of a National Science Foundation (H.R. 4846) is being held up in the House Rules Committee which is said to be hesitant for the present about taking on the new financial commitments the bill will require. Also held up in the House Rules Committee is the Public Works Advance Planning Bill (H.R. 5739). Similarly H.R. 5472 providing for rivers and harbors construction is delayed.

The Classification Revision Act of 1949 (H.R. 5931) providing a pay raise for Civil Service employees and for the establishment of a new classification system, with the present $10,330 salary ceiling raised to $15,000, has been reported out of the House Civil Service Committee, and is now in the Rules Committee. A similar bill has cleared the Senate. With the rush to wind up this session, there is some doubt that various bills in the Rules Committee will come up for final action before Congress reconvenes next January.

Supreme Court Declares Water Companies Subject to Labor Laws

A decision of interest to irrigation engineers was handed down by the Supreme Court of the United States on June 27 in the case of McComb, Administrator of the Wage and Hour Division, vs. the Farmers Reservoir and Irrigation Company of Colorado. In this case, the mutual water company which distributed water only to its stockholders for use on their lands, failed to comply with the Wage and Hour and other provisions of the Fair Labor Standards Act, claiming that its employees were exempt. These employees were ditch riders, maintenance men, and office workers. The company obtained and supplied the water entirely within Colorado, but the crops on which the water was used entered into interstate commerce. The question was whether these employees of the water company were engaged in interstate commerce by virtue of engaging in an occupation necessary to crop production and, if so, were they not engaged in agriculture which is exempt under the Act.

The court held them to be under the Act—engaged in commerce because their work was a process necessary to the production of crops, yet not exempt because they were held not to be engaged in agriculture but a separate occupation.

President Signs Public Law 177

With the President's signature to Public Law 177, amending the Fair Labor Standards Act, claims for "overtime on overtime" compensation will not be valid. The legislation provides, in substance, that: (1) No overtime need be paid or any extra compensation paid for Saturday, Sunday, or holiday work, provided the pay for these days is not less than one and a half times the regular rate, and (2) no statutory overtime need be paid on any extra compensation the employee receives by virtue of an employment contract or labor agreement for work outside the regular work day or week, subject to certain provisions of the act. Public Law 177 amends Section 7 of the Fair Labor Standards Act of 1938.

Washington Construction Projects

Construction projects under way in the nation's capital that can be visited by members attending the Fall Meeting are described in the program and announcement of the meeting.

Washington, D.C.
August 23, 1949

Mid-South Section Forms Branch at Jackson, Miss.

TO ACCOMMODATE ASCE members in the Jackson, Miss., area the Board of Directors of the Mid-South Section recently gave approval to formation of a Jackson Branch. The new Branch, which has a present membership of 34, includes Hinds, Rankin, Copiah, and Madison counties. Because of the sparse Society membership in the Jackson area, membership in the Branch will also be permitted members in any remaining unallocated portions of the state.

Officers of the new Branch, elected at a charter meeting of the group, are Haywood G. Dewey, Clinton, President; Sydney W. Chandler, Jackson, vice-president; and Margaret S. Peterson, Clinton, secretary-treasurer. Directors are Herbert H. Lester, Clyde V. Maxwell, Boyce H. Biggers, and Irving E. Anderson.

Establishment of the Jackson Branch brings to three the number of local groups needed to serve the Mid-South Section. The other Branches are at Little Rock, Ark., and Vicksburg, Miss.

Oregon Section Committee to Make Earthquake Study

THE OREGON SECTION has appointed a Structural Division to study the effects of the April 1949 earthquake and to make

recommendations for possible changes in local and state building codes to meet earthquake-proof construction requirements. In cooperation with the ASCE Northwest Conference Earthquake Committee, the Division is seeking information from all private consulting engineers in the state to make its study as complete and helpful as possible to the structural branch of the profession.

NEWS OF LOCAL SECTIONS

Coming Events

Indiana—A joint meeting of the Local Sections in District 9 will be held at Clifty Falls Park, Ind., on Saturday and Sunday, September 17 and 18. A special conference of Section delegates has been called by ASCE Director from District 9, Dean D. V. Terrell, who will serve as chairman of the joint meeting.

Sacramento—Regular luncheon meetings in the Elks Club, Sacramento, every Tuesday at 12:30 p.m.

Spokane—Meeting of the Columbia Branch of the Section, at the Desert Inn, Richland, Wash., September 8, at 6:30 p.m.

Texas—Luncheon meetings of the Dallas Branch at the Adolphus Hotel, Dallas, on September 12 and October 3 at 12:15 p.m. Luncheon meeting of the Fort Worth Branch at the Blackstone Hotel, Fort Worth, September 12, at 12:15 p.m.

West Virginia—An inspection trip through the Philip Sporn Plant of the Appalachian Electric Power Co., at New Haven, W.Va., on September 23, will be followed by a dinner meeting at the Moose Club, Point Pleasant, W.Va. Members of the West Virginia Society of Professional Engineers have been invited to attend the dinner meeting.

Recent Activities

COLORADO

LOCAL GROUPS OF both the Structural and Irrigation Divisions of ASCE have been formed by the Colorado Section. At the organizational meeting of the Section's Structural Division, which was attended by 40 members of the Section, Hal W. Berkeland and W. A. Hohlweg, of the International Engineering Co., described engineering highlights of a recent trip to India and Ceylon. Division officers for the next year are Robert Sailer, chairman; Bruce Johnson, vice-chairman; and Hugh Hempel, secretary. The 35 members attending the charter meeting of the Section's Irrigation Division heard Don S. Mitchell, operation and maintenance supervisor of the South Platte District of the Bureau of Reclamation, discuss land classification and its relation to successful irrigation development. Officers elected are Herbert E. Prater, chairman; S. H. Streater, vice-chairman; and Carl Wilder, secretary.

LOS ANGELES

THE LOS ANGELES SECTION announces that its annual awards of Junior membership in the Society for civil engineering students showing "the greatest promise in the profession" have been made to Charles F. Forester, of California Institute of Technology, and Jesse L. M. Kitchens of the University of Southern California.

LOUISIANA

LONG-RANGE PLANS for the development of New Orleans were outlined at a joint meeting of the Section and the Louisiana Engineering Society by Russell H. Riley, partner in the St. Louis firm of Harland Bartholomew & Associates, which has been retained by the city to study the factors affecting future growth of the city and to make recommendations for a master plan. Mr. Riley explained the various factors his firm had to consider in drawing up the plan, supplementing his talk with graphs and charts showing the estimates of future population movements, traffic routing, and other elements involved in preparing the plan. There was a record turnout of 300.

MARYLAND

THE LAST DINNER meeting of the season was devoted to a social program. President Gurney H. Dayett described recent visits he had made to the Student Chapters at Johns Hopkins University and the University of Maryland, where he presented Section awards of Junior membership in the Society to graduating seniors with the highest scholastic averages. The meeting was then turned over to the entertainment committee which featured a program of songs and impersonations.

TOTAL MEMBERSHIP AS OF AUGUST 9, 1949

Members	7,452
Associate Members	9,629
Corporate Members	17,081
Honorary Members	40
Juniors	9,067
Affiliates	72
Fellows	1
Total	26,261
(August 9, 1948	23,904)

METROPOLITAN

BASEBALL, VOLLEY BALL, and swimming were enjoyed by both men and women attending the Junior Branch's annual summer outing at Lake Idle Wild, N.J., early in August. This year the group gave up the inspection trip, traditionally featuring its summer outing, in favor of "a day of unadulterated loafing far from Herald Square and Mohr's Circle," as the invitations read. About 35 attended.

MONTANA

PROPER PROPORTIONING OF aggregates to give adequate workability with the minimum amount of cement makes concrete one of the most economical and satisfactory building materials in the construction industry, C. E. Stahl, Montana state highway engineer, told members of the Section. Speaking on "Results of Field Studies in Concrete Structures" at a recent meeting, Mr. Stahl warned that precautionary measures applied to the mix will, however, be lost, if proper methods of curing are disregarded. He recommended the steam cure, rather than use of salamanders, in freezing weather. Curing methods observed definitely show that concrete kept wet for a week with a tapering-off period is more durable and least likely to crack, he stated. In conclusion, Mr. Stahl described several Mid-Western projects and the reasons for success or failure of the structural concrete in each. During the business meeting, Paul M. Johnson discussed the advisability of forming a Branch at Hungry Horse, where there are 25 ASCE members.

PHILADELPHIA

GOLF, SOFTBALL, AND other sports were enjoyed by members of the Philadelphia Section at the traditional outing at the Bala Golf Club that concluded the season's activities. After-dinner entertainment included a demonstration of the art of hypnotism and an illustrated talk on a recent trip to England by M. Buck, vice-president of the Philadelphia Electric Co. Joseph R. Farrell was chairman of the committee in charge of arrangements.

PROVIDENCE

THE SOCIETY'S PLANS for coping with increased operating costs were outlined by ASCE Director Harold L. Blakeslee

in a review of current activities of the Board of Direction given at a recent dinner meeting. The showing of Navy service films on the Bikini atomic bomb tests, Antarctic explorations, and other subjects concluded the technical program. During the business meeting, Frederick H. Paulson was elected president for the coming year; Waldo W. Smith, vice-president; and Kendall Moultrop, secretary-treasurer.

NORTHWESTERN

USE OF HIGH speed computing machines as engineering tools was explained at a recent meeting by Newman A. Hall, professor of mechanical engineering at the University of Minnesota. R. W. Lindsey, Jr., president of the Junior Forum, then summarized the aims and activities of the Forum during the past year. For the 25th year, the Section awarded prizes of engineering handbooks to outstanding students at colleges in the District. Winners were: Duane Schue, of the University of North Dakota; Robert J. Walsh, of the South Dakota School of Mines; Howard W. McCauley, Jr., and John P. Wold, North Dakota State Agricultural College; Frank Bleckinger, of South Dakota State College; and Russell Holcomb, John Holcomb, and Warren Carter of the University of Minnesota.

TENNESSEE VALLEY

OAK RIDGE AND its sister atomic city, Richland, Wash., are uniquely able to utilize a master plan, because they are war-born cities without precedents or traditions, L. Z. Dolan, chief engineer of the Community Construction Division of the Atomic Energy Commission, told members of the Oak Ridge Sub-Section at a recent meeting. Speaking on the Oak Ridge master plan, Mr. Dolan discussed the various features of the plan as they will affect residential and business areas. In the absence of President Lavers, G. J. Angele presented the proposed plan for ASCE regional reorganization.

The newly reactivated Muscle Shoals Sub-Section met in Florence, Ala., recently to decide on a schedule of programs for future meetings. T. D. Lebby, guest from the Chattanooga Sub-Section, described the activities and experiences of his group. The remainder of the meeting was devoted to showing the documentary film entitled "The River."

The struggle to achieve unity among the various branches of the engineering profession was outlined by N. W. Dougherty, dean of the University of Tennessee Engineering School, at a recent meeting of the Chattanooga Sub-Section.

TRI-CITY

WITH A BACKLOG of hundreds of needed projects, there is little chance the Army Corps of Engineers will ever "become rusty from disuse," Col. Clark Kittrell, division engineer for the Mississippi Valley Division, said in an address before a joint meeting of the Section and the Rock Island County chapter of the Reserve Officers Association. The achievements of the Corps of Engineers have been as important to the nation's peacetime growth as to our wartime military victories, Colonel Kittrell pointed out. The civil works program of the Corps, which opened waterways for cheap bulk transportation, he described as beneficial to all other forms of cargo carrier. By opening undeveloped areas for industry, inland water transportation created new business and promoted the "overall beneficial growth" of highway, rail, and air carriers, he declared. Albert F. Burleigh, of Moline, was in charge of the meeting program, and Philip H. Switzer, of Moline, acted as master of ceremonies.

COL. CLARK KITTRELL, M. ASCE, chief of Upper Mississippi Valley Division of Corps of Engineers (left) is photographed at dinner of Tri-City Section with Col. R. L. Dean, chief of Rock Island District, and C. G. Tolson, president of Rock Island County Chapter of Reserve Officers Association.

PITTSBURGH SECTION

AN INSPECTION TOUR of the Squirrel Hill Tunnel and the Commercial Street Bridge, two major projects now under construction in connection with the building of the Penn Lincoln Parkway, was made recently by 130 members of the Pittsburgh Section and their guests. At a luncheon preceding the trip, a panel of speakers connected with the project briefed the members for the trip. Paul Ambler, district engineer for the Pennsylvania Department of Highways, outlined the general features of the parkway project, and Don Phinney engineer for B. Perini & Sons on the Squirrel Hill Tunnel, described the tunnel design. Interesting facts connected with the design of the bridge and interchange for the project given by George Heinisch, Jr., bridge engineer for the Pennsylvania Department of Highways, concluded the luncheon.

WEST PORTAL OF SQUIRREL HILL TUNNEL, Penn-Lincoln Parkway Project, is viewed by large group of Pittsburgh Section members and their guests on recent inspection trip.

SEATTLE

ENGINEERING AND GEOLOGICAL aspects of earthquakes were described in a symposium on the recent Pacific Northwest earthquake presented at a recent meeting. C. E. Weaver, professor of geology at the University of Washington, traced the geological history of the region, and explained how the structure of the earth's crust is responsible for earthquakes. A. L. Miller, professor of mechanics and structures at the University of Washington, stated that too little is known regarding the engineering aspects of earthquakes, and recommended the formation of Society groups that would be prepared to obtain data on earthquake damage in the event of another disturbance in the area. The findings of a group of Seattle engineers and architects, who have been studying the advisability of making changes in the Seattle Building Code to counter earthquake effects, were reported by Cecil Arnold. At another recent meeting Paul P. Ziegler, director of research for the Permanente Metals Corp., spoke on aluminum alloys.

SPOKANE

KENNETH BROOKS, SECTION Junior and 1948 winner of the Plynn Fellowship, under which outstanding young architects are able to study abroad, described many modern European developments in building design and city planning at a recent meeting. Mr. Brooks supplemented his talk with slides he made during his year abroad. The terms of the fellowship were described by Carroll Martell, Spokane architect, who introduced Mr. Brooks.

TEXAS

THE TRINITY RIVER Development Plan is the first completely coordinated program for watershed development in the world, according to Robert N. Tharp, educational director of the Trinity River Improvement Association. Addressing a luncheon meeting of the Fort Worth Branch, Mr. Tharp stated that the program, which is being handled by five separate government agencies, will provide for flood control and soil conservation. When completed, it will triple the storage capacity of the headwaters of the Trinity. Possibilities for exploiting the natural resources of the state were outlined at another meeting by Robert Stone, of the Texas Electric Service Co. Mr. Stone spoke, particularly, of achievements in the field of organic chemistry in developing soil resources.

WEST VIRGINIA

SECTION INSPECTION OF the new $3,500,000 Star City Road and Bridge project of the West Virginia State Road Commission was followed by a dinner meeting devoted to discussion of the structure. Wilson Ward conducted a tour of the project, which consists of continuous three-span approach girders and a 411-ft central truss span. The grading of the road bed includes several deep hillside cuts and high hillside fills, involving problems in stabilization. Planning and design of the project were described during the dinner meeting program by G. W. McAlpin, C. A. Rothrock, Dave W. Johns, and F. A. Simmons, all of the State Road Commission.

WISCONSIN

DEVELOPMENTS IN MODERN railroad engineering were discussed at a recent meeting by W. H. Huffman, division engineer of the Chicago & Northwestern Railroad. A colored film showing the historical background of American railroads supplemented his talk. The construction and operation of atomic energy plants in this country were described at another recent meeting by John Willard, research physicist at the University of Wisconsin and former staff member of the Hanford Engineering Works.

ST. LOUIS SECTION

A THREEFOLD PROGRAM for decreasing the hazard of fires in hotels, hospitals, and public buildings was presented by Albert H. Baum, building commissioner of the City of St. Louis, at a joint meeting of the Section and the Washington University Student Chapter. Mr. Baum advocated adoption of a state building code establishing minimum standards for all new building construction and for additions and alterations to existing buildings; enactment of statutes compelling existing buildings to meet certain structural and fire-safety requirements within a reasonable time; and creation of a state agency for enforcement of the state building code and auxiliary ordinances. Brief talks by students concluded the technical program. A Section award of Junior membership was presented to W. P. Williams, of Washington University. A. B. Hensely, of the University of Missouri, received the Section's other Junior membership award.

SPECIAL PROBLEMS INVESTIGATED BY WASHINGTON UNIVERSITY STUDENTS in their engineering work were discussed at recent joint meeting with St. Louis Section in series of three-minute talks by (left to right) Richard Halteman, Jr., Robert Brown, Robert F. Landau, and Vernon F. Weber.

VIRGINIA SECTION

THE SUMMER MEETING of the Virginia Section featured an inspection tour of the $78,000,000 Buggs Island multi-purpose dam project under construction on the Roanoke River in south central Virginia. Highlight of the meeting was a talk by Maj. Gen. Lewis A. Pick, Army Chief of Engineers on the importance of the project to the Roanoke River basin plan. Purposes of the plan, as explained by General Pick, include flood control, navigation, generation of hydroelectric power, regulation of river flow, and pollution abatement. The meeting, one of the most successful in the history of the Section, was attended by more than 400 engineers and their guests from Virginia and North Carolina. Participating organizations, in addition to the Virginia Section, included local groups of the ASME and AIEE, the Virginia Society of Professional Engineers, the Engineers Club of Hampton Roads, the Virginia Peninsula Engineers Club, and other regional engineers' clubs.

MEMBERS OF VIRGINIA SECTION visit Buggs Island Dam and Powerhouse area, where construction is under way, during recent annual summer meeting.

NEWS BRIEFS

Slight Increase in Construction Activity Reported

MORE THAN SEASONAL increases in construction activity in July, giving it a slight lead over the high levels of July 1948, are reported by the Department of Commerce. New construction put in place during the month, with an estimated value of over $1.9 billion, was about 10 percent above the revised estimate for June, and 2 percent above the July 1948 total, according to the Construction Division of the Department. On a seasonally adjusted basis, the value of new construction for the month represented a 4 percent increase over the revised June total.

For the second consecutive month, private construction showed a greater gain than public construction, primarily as a result of the rise in residential building. The value of new private construction put in place in July reached nearly $1.4 billion, an advance of 11 percent over the June estimate, in comparison with a 7 percent increase in public expenditures for new construction, which amounted to a total of $542 million.

Private non-farm homebuilding in July, with a value of $700 million, for the first time this year almost equaled 1948's record levels, according to joint estimates of the Departments of Commerce and Labor. The increased number of new non-farm dwellings placed under construction in the past three months brought the value of residential construction in July up to within 1 percent of the July 1948 estimate. Despite this fact, the value of private residential construction for the first seven months of 1949 was still 10 percent below the total for the corresponding period of 1948, because of the smaller number of housing units started during the early months of this year.

Industrial and commercial construction continued to represent the weak spots in the private construction field, while other types of non-residential building (religious, educational, hospital, and recreational)gained by greater than seasonal amounts in July to remain about 40 percent above the level of the first seven months of last year. Construction of privately owned public utilities advanced 6 percent in July to retain a substantial lead over a year ago.

The margin by which public expenditures for new construction exceed those of 1948 has been declining since April, according to the Department. This development represents a tapering-off in the school and hospital building programs, which were principal contributors to the expansion of public construction in the early months of this year. Highway construction expenditures increased by a more-than-seasonal 14 percent in July. Small increases in most other types of public construction were largely seasonal.

The total value of new construction put in place during the first seven months of 1949 amounted to over $10.3 billion, 3 percent more than the $10.0 billion recorded for the same period in 1948. Private construction for the period, valued at nearly $7.6 billion, was 5 percent under the total for the first seven months of 1948. However, the value of public construction rose 33 percent during the comparable period this year, reaching a total of about $2.8 billion.

Reclamation Officials Chart Huge Building Program at Annual Conference

A $350,000,000 CONSTRUCTION program for the fiscal year beginning July 1 was outlined by Bureau of Reclamation officials at the Bureau's five-day annual conference of directors and top officers of its seven reclamation regions, which was held at Boulder City, Nev., early in August. The over-all program is expected to yield irrigation for some 400,000 additional acres of land, and 500,000 kw of additional power, increasing both the Bureau's irrigation and power facilities by about 10 percent.

Work on 46 projects, including 35 storage dams, eight power plants, and over 200 miles of canals, is involved in the program. In addition to the projected increases in irrigation and power, there will be flood control, recreation, fish and wildlife conservation, municipal water, silt control, and other benefits. No major new projects are contemplated, but work will continue on the Hungry Horse Dam in Montana, Davis Dam in Colorado, the Colorado-Big Thompson Project, and Missouri River Basin, Columbia River Basin, and Central Valley (California) projects.

Described as "the biggest and most challenging program" yet proposed by the Bureau, the current program tops by many millions the organization's $174,000,000 budget for 1947 and its $210,000,000 program for 1948. It is part of a USBR six-year continuing program that calls for approximate doubling of present irrigation and water facilities in the 17 Western states within the reclamation area by June 1956.

Commenting on the proposed program, Reclamation Commissioner Michael W. Straus asserted that, "The West needs more water and more power so urgently that there is no room for guess work or stumble-footed performance if this program is to succeed. We are now just about half done with the big job of developing the irrigation, hydroelectric, power, and other water resources which our investigations indicate we can carry out under present-day technical and economic conditions," he added.

Though congressional authorization for the 1950 program is still pending, Mr. Straus explained that the program will be adjusted to fit congressional appropriations after House and Senate committees agree on the 1950 appropriations bill.

National Sanitation Group Holds Annual Conference

RESOLUTIONS URGING the development of an expanded sanitation program on a national scale and the establishment of community-wide educational programs in the field were passed at the recent Conference on a National Sanitation Program, sponsored by the National Sanitation Foundation at Ann Arbor, Mich.

John H. O'Neill, chairman of the ASCE Sanitary Engineering Division, represented the Society at the two-day conference, which was attended by delegates from 28 engineering, planning, and public health organizations.

Bids Asked on 130-Mile New Jersey Superhighway

INITIAL BIDS ON New Jersey's new 130-mile superhighway through the state will be sought by the New Jersey Turnpike Authority about December 15, according to an announcement from Paul L. Troast, chairman of the Authority. Since the Authority will adopt the prequalification procedures used by the New Jersey State Highway Department in obtaining bids, contractors must file complete qualification applications at least 20 days before they can bid on turnpike work. This means, according to Mr. Troast, that applications must be in not later than mid-October in order to allow sufficient time for determining contractors' qualifications.

Work on the turnpike will involve bridge foundations, superstructures, grading, drainage, pavement, buildings, and electrical, plumbing, and mechanical equipment. Grading, drainage, bridge foundations and superstructures will be undertaken initially, with paving, construction of buildings, equipment, signs, communications, electrical illumination, and landscaping to follow.

Contractors may obtain application forms from the New Jersey Turnpike Authority, State House, Trenton, N.J.

Steelwork for U.N. Secretariat Building Put in Place

STEEL CONSTRUCTION IS ABOUT HALF COMPLETED for 42-story Secretariat Building, first unit in United Nations permanent headquarters on East River in mid-town Manhattan. More than 13,000 tons of steel will be used in building, with framework scheduled for completion by October 1 and building ready for occupancy by late 1950. Following signing of recent $2,225,000 contract with American Bridge Co. for furnishing and erecting structural steel for Council Chamber, work on this supplemental unit will soon begin at headquarters site. U.N. Building program involves construction of 70-ft vehicular tunnel under First Avenue and rearrangement of public utilities in front of development. About 15 months will be required for $2,280,000 renovation project, involving laying of new sewers, steam and water mains, electrical cables, gas pipes, and other utilities. Careful "cutovers" will prevent interruptions to service. Franklin D. Roosevelt Drive is shown in right foreground of photos.

Engineering Firms Retained for Delaware River Studies

ENGINEERING INVESTIGATIONS FOR the Interstate Commission on the Delaware River Basin (Incodel) to enable it to carry out the directives of the 1949 New York, New Jersey, and Pennsylvania legislatures to determine the optimum use of Delaware River waters will be conducted by the New York City firm of Malcolm Pirnie Engineers, according to an announcement by James H. Allen, M. ASCE, executive secretary of Incodel. Albright & Friel, consulting engineers of Philadelphia, will be associated with the Pirnie organization in the investigations.

Mr. Hunt stated that the survey, the first of its kind ever undertaken by a group of states, may "conceivably set a new pattern for the development and construction of water resources projects in the major river watersheds of the nation. Every effort will be made in the Incodel survey," he continued, "to formulate a plan that will be mutually beneficial to all of the varied interests of the region."

The survey will cover investigation of municipal and industrial water supply, recreational uses, flood and salinity control, pollution abatement, navigation, and generation of power and related uses.

Army Engineers Start Work on Belton Dam

CONSTRUCTION HAS JUST been started on Belton Dam and Reservoir, a $20,500,000 Texas flood control and conservation project, according to an announcement by Lt. Col. Ellsworth I. Davis, Assoc. M. ASCE, district engineer of the Galveston District of the Corps of Engineers, under whose direction the project is being built. Located on the Leon River, about 8 miles west of Temple, Tex., the dam will be approximately 5,100 ft long and will rise 190 ft above the stream bed. About four years will be required for its completion.

Early contracts for construction of the earth embankment have been awarded to the Hunder Construction Co., of Ada, Okla.

Hydraulics Experts Address Fourth Annual Conference

AN AUTHORITATIVE PRESENTATION of hydraulics as a broad engineering science by leaders in the field featured the recent Fourth Hydraulics Conference, to which the Iowa Institute of Hydraulic Research, State University of Iowa, was host. The program for the three-day conference consisted of the reading and discussion of 13 papers, prepared by experts at the invitation of the Institute, which will form the consecutive chapters of a book on *Engineering Hydraulics*.

Authors represented in the forthcoming book are Hunter Rouse, J. E. Warnock, J. W. Howe, G. R. Williams, C. E. Jacob, V. L. Streeter, J. S. McNown, A. T. Ippen, C. J. Posey, C. B. Brown, and J. W. Daily, Members ASCE, and B. R. Gilcrest and G. H. Keulegan. Subjects range from "Fundamental Principles of Flow" to "Hydraulic Machinery."

Inspection of the research facilities of the Institute constituted the final session. Of special interest to the group were the new Hydraulics Laboratory Annex, the sediment flumes, and the air and water tunnels. All experimental units were in operation. Dean and Mrs. F. M. Dawson held open house for conference guests on the Sunday afternoon and evening preceding the conference.

The record-breaking attendance of 430 included ASCE President Franklin Thomas, Past-Presidents W. W. Horner and J. C. Stevens, and Honorary Members Boris A Bakhmeteff and Gerard H. Matthes. The two latter led technical discussions of main papers.

Armco Steel Corp. to Build Large New Plant

IMMEDIATE CONSTRUCTION OF a new $12,000,000 steel plant, with a production capacity of 400,000 tons of steel ingots a year, has been authorized by the Armco Steel Corp., according to a recent announcement by Charles R. Hook, chairman of the board. To be built adjacent to the organization's East Works plant at Middletown, Ohio, the new plant will constitute one of the largest construction projects to be started in the Miami Valley in recent years. The project will include construction of three 225-ton open-hearth furnaces of the latest design, to be housed in a 200 by 700-ft main building incorporating 7,000 tons of structural steel. It is estimated that construction will require 15 months.

Contract Construction Employment Rises in July

CONTRACT CONSTRUCTION EMPLOYMENT totaled 2,149,000 in mid-July, an increase of 71,000 from the mid-June total, according to preliminary estimates of the Bureau of Labor Statistics of the Department of Labor. All sections of the country shared in the increase, with the largest gains reported in the Middle Atlantic and North Central states.

Construction contractors had 70,000 fewer persons at work in mid-July this year than in July 1948. Employment was higher in the South Central and Middle Atlantic states, but all other regions were below the July 1948 level, with the sharpest drops reported in the Pacific and South Atlantic states.

Waterways Station Expands Its Concrete Research Work

CONCRETE RESEARCH ACTIVITIES of the Waterways Experiment Station at Vicksburg, Miss., were greatly expanded with the recent opening of a new sub-office and laboratory addition to the facilities of the Concrete Research Division at Clinton, Miss. The new quarters of the Concrete Research Division, which was established in 1946, are located on an 820-acre reservation at Clinton, 40 miles east of Vicksburg and near Jackson.

Large-scale investigations underway in the Clinton Laboratory include the use of air entrainment in concrete design; the suitability of Prepakt concrete for mass concrete dams; and procedures and techniques for applying vacuum treatment to both formed and unformed surfaces of mass concrete.

Demonstrations on July 28 and again on August 4 attracted a group of engineers from District and Division offices of the Corps of Engineers, from the Navy Bureau of Yards and Docks, and from the Bureau of Reclamation, to witness placement and vacuum treatment of concrete. Since the Corps of Engineers has been licensed to employ both Prepakt and vacuum processes (patented) on its civil works, the laboratory is investigating proper methods and techniques for their use.

The director of the Waterways Experiments Station is Lt. Col. R. D. King, Assoc. M. ASCE. H. K. Cook is chief of its Concrete Research Division and directs the investigations concerned with concrete.

NEW OFFICE AND LABORATORY ADDITION of Waterways Experiment Station, occupied in July by Station's Concrete Research Division, is shown in upper view. Center photo depicts experimental bridge pier built of Prepakt concrete by filling forms with coarse aggregate (larger than $^3/_4$ in.) and pumping in grout to fill voids. Test block in bottom photo reproduces features of mass concrete gravity dam. Vacuum process applied to forms removes excess mixing water and compacts concrete after placement.

Building Industry Declared Partially Readjusted

AN ANALYSIS OF construction trends since V-J Day indicates that the building industry is about at midpoint of the postwar adjustment phase, according to Thomas S. Holden, president of the F. W. Dodge Corp., fact-finding organization for the construction industry. Writing in a current issue of *Architectural Record*, Mr. Holden establishes September 1948, when the all-commodity index of wholesale prices turned down, "as the date when the adjustment phase of postwar recovery succeeded the backlog and shortage phase."

Characteristics of the present market adjustment phase, he states, have been the disappearance of acute shortages, gray markets, and order backlogs, with the return of competition, downward price movements, and temporary cutbacks or postponements of industrial programs. This general adjustment, Mr. Holden points out, has been reflected in a reduction of the physical volume of production, a significant drop in the wholesale commodity index, decline in employment, and decline in both the dollar and physical volume of construction.

"Potential expansion factors in our economy are very great, perhaps greater than ever before," according to Mr. Holden. "They include our growing population, our position of world leadership, our high productivity, our tremendous volume of liquid savings, our habits of ready adaptation to change, our high competence in business and industrial management and construction techniques, and the energy and resourcefulness of our people."

Mr. Holden anticipates increases in commercial, industrial, school, hospital, public, religious, social and recreational building. Heavy engineering construction, public and private, is held likely to increase continuously to keep pace with the needs for expanded community facilities, power, traffic, transportation needs, and the like. Large backlogs of planned projects exist now, according to Mr. Holden. "Residential building should continue relatively high, though probably less than the 1948 volume, during the next few years," he observes.

Contract Awarded for New Duquesne Co. Power Plant

A CONTRACT FOR construction of the $28,000,000 power plant of the Duquesne Light Co., Pittsburgh, to be built on the Monongahela River at Elrama, Pa., has been awarded the Dravo Corp., Pittsburgh. Initially the plant will contain two 95,000-kw steam turbine generators. Other features of the project, to be located on a 23-acre tract between the Pennsylvania Railroad tracks and the river, include electrostatic dust precipitators, a coal-unloading dock on the river, a mechanized coal-handling system, outdoor switching facilities, and a screen house.

Construction of the plant will begin early next year, with completion scheduled for the middle of 1952. The project will round out the Duquesne Company's postwar expansion program, which calls for an outlay of $112,000,000 to serve the needs of the Pittsburgh area.

Sanitary Engineers Asked to Submit Personnel Data

TO ASSURE SANITARY and public health engineers proper utilization of their professional training in the event of a national emergency, the American Public Health Association, in cooperation with the National Security Resources Board, is preparing a roster of their skills. This roster will supplement and bring up to date the roster prepared by the War Manpower Commission.

Distribution of questionnaires to be used in gathering the basic information needed in preparing the roster was begun on July 1. Engineers in the sanitary and public health fields who do not receive a questionnaire within the next two or three months should notify the Engineering Section Project of the APHA, 1790 Broadway, New York.

Paterson, N.J., Undertakes Traffic and Parking Survey

TO RELIEVE ITS traffic and parking congestion, the City of Paterson, N.J., has authorized the Knappen Tippetts Abbett Engineering Co., of New York City, to make a comprehensive economic and engineering study of its parking problem. Day and night surveys of parked cars in the central business district will be made to determine the origin and destination of parkers, the present parking pattern and volume, and future parking demand. From these data, the number, type, and location of off-street parking facilities required to relieve the present congestion will be determined.

The Paterson Parking Authority is one of the first to be formed in the state under the recently enacted New Jersey "Parking Authority Law."

Publications on Fire Prevention Available

TO FAMILIARIZE THE engineering profession with the fire-preventive features of design and construction that must be considered in most construction work, the National Board of Fire Underwriters is making available to the profession without cost its technical standards and publications. Inquiries should be addressed to the National Board of Fire Underwriters, 85 John Street, New York, or to the Chicago (222 West Adams Street) or the San Francisco (1014 Merchants Exchange) offices of the organization.

Groups of recommended standards are available in each of the following classifications: Fire Extinguishing Appliances; Fire Extinguishing Auxiliaries; Flammable Liquids; Combustible Solids; Hazardous Gases; Explosive Dust; Electrical Equipment; Construction; Research Reports; Special Technical Reports; Fire Prevention Education; Fire Department Suggestions; Public and Semi-Public Structures; Natural Hazards; Special Problems; Suggested Codes and Ordinances.

AEC to Build Huge Atomic Reactor Plant in Idaho

A HALF-BILLION-DOLLAR field station for testing uses of atomic energy will be built near Arco in the desert of southeastern Idaho, according to a recent announcement from the Atomic Energy Commission. Comparable in size to the atomic energy works at Hanford, Wash., the new plant will consist largely of a series of atomic reactors, to be used for testing uses of atomic energy. "The project will be exclusively a field facility for laboratories working on the Commission's nuclear reactor development program, and for other laboratories needing a field test site," according to Robert F. Bacher, AEC Commissioner. Projects to be undertaken at the field station include the utilization of atomic energy for ship propulsion, Mr. Bacher stated.

Early contracts for the Arco Project, which will be the largest single industrial development in the Far West in 1949, have been awarded to Lockwood, Kessler & Bartlett, of Brooklyn, N.Y. Headquarters for the project will be at Pocatello.

Survey of Seattle Earthquake Damage Shows Need for Special Design

THE IMPORTANCE OF designing fire-protective and water-supply systems against earthquake shocks in active seismic areas is emphasized by a survey of damage caused by the recent earthquake in the Seattle area, made by the Factory Mutual Engineering Division and reported in a recent issue of the *Factory Mutual Record*. The report states that the fact the earthquake was centered about 30 miles southwest of the city, near the centers of previous less severe shocks "confirms that western Washington is an active seismic area."

Property damage, estimated at more than $15,000,000, was found to be marked in the case of sprinkler systems without special earthquake design. "Where pipes were held firmly in foundation walls and the ground was soft, the pipe broke at the wall or a few feet outside," the report states. "Indoors, risers without flexible couplings broke at bottom flanges when risers were tightly cemented into concrete ground floors. In several buildings, elbows in tank drops broke just under the roof . . . Swaying and vibration of large overhead sprinkler mains not adequately secured resulted in the breakage of smaller connected pipes. One interesting instance was reported of a sprinkler head being sheared off by contact with a beam normally 5 in. away."

None of the city's many small roof sprinkler tanks, built largely of wood, on 25-ft steel trestles or on brick stair or elevator towers, were designed to withstand earthquake shocks, and most of them were severely damaged. However, the survey shows that automatic sprinkler systems and gravity tanks installed in accordance with recommendations of the Engineering Division, suffered no major breaks. Methods of protection employed consisted principally of increasing the flexibility between major parts of the sprinkler system. This was accomplished by means of flexible couplings on risers, clearances where pipes pass through walls and doors, and anchors and braces to prevent excessive sway.

There were relatively few breaks in the underground mains of the Seattle water system, and all serious breaks were repaired within six hours.

Though modern office and commercial buildings with steel and concrete frames, located on firm high ground, revealed only such minor damage as cracked plaster and broken windows, old brick buildings of the wall-bearing type, on filled ground, were badly shaken. The report states that, "Some walls bowed outward, some were badly cracked, and a few disintegrated. The weakness of old lime mortar was a factor. Poorly anchored brick parapets were thrown off, and numerous brick gables were thrown out."

ROOF SPRINKLER TANKS, damaged in recent Seattle earthquake, show importance of earthquake-proof design in seismic areas. In view below, concrete trestle supporting 54,000-gal tank on top of warehouse sheared, letting tank plunge onto roof. Grillage beams under tank that rolled over are shown in left-hand photo.

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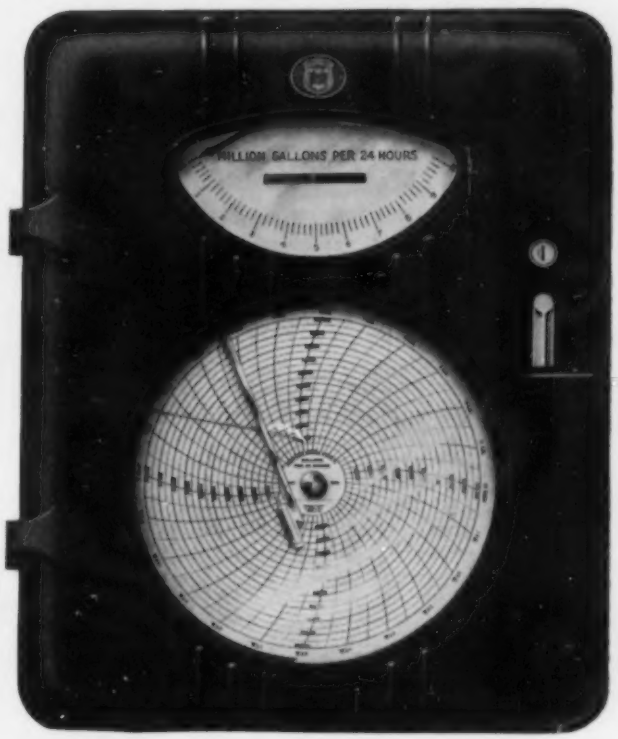

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Moles' Annual Outing Draws Large Attendance

ALMOST 1,000 MEMBERS and guests of The Moles, New York society of heavy construction men, were on hand for the organization's annual outing and clambake at Travers Island, Pelham Bay, on August 17. A day of swimming and keenly contested games and sports was followed by a show in the evening. Carlton S. Proctor, ASCE Vice-President and president of The Moles, presided at the evening entertainment and awarded prizes to the winners of the various sport events.

Industrialists Advised to Hire Good Technical Men

INDUSTRY TODAY MUST scout for good technical men and give them the laboratory tools to work with, Charles F. Kettering, Hon. M. ASCE, research consultant for the General Motors Corp., told industrialists and others attending recent ceremonies in Dayton, Ohio, that marked the 40th anniversary of the incorporation of the Dayton Engineering Laboratories Co. (Delco).

One of three former Delco employees honored for their pioneer work in the automotive field, Mr. Kettering compared the work of early automotive inventors with today's research technicians. "We must never impose limits on the minds of men," he said. "We can have a brilliant future, a future we can't even visualize now, if we continue to encourage our inventors and technical men. Industry can't afford to do otherwise," he emphasized.

Multiple-Wheel Landing Gear Increases Runway Capacity

FURTHER DEVELOPMENT OF landing gear having dual wheels, or dual wheels in tandem, to spread the weight of airplanes on airfield pavements, is described as an urgent necessity because of the increasing weight of all kinds of aircraft, in a recent issue of *Out at the Airport*, publication of the Airport Division of the American Road Builders' Association. Use of such gear may make it possible for the Civil Aeronautics Administration to remove its limitations on airplane-weight and runway-strength standards, according to the publication. Such operations as the Berlin Airlift "underline, as nothing else could, that big planes are needed for mass transportation of freight by air," it declares, pointing out that fewer and heavier aircraft make for economies.

"Modification of aircraft landing gear seems more practical than to require sponsors to strengthen existing airfield pavements, expending public funds to service the heavier aircraft which are surely coming," the publication states, suggesting that distribution of aircraft weight "could be accomplished much after the fashion employed on heavy truck trailers, which are carried on multiple axles and dual wheels.

"Emergency landing gear having immense footprint area, though satisfactory for military use in rough terrain, is not enough to prevent airfield pavement damage, due to repeated overloading," it continues. "Proper spacing and a number of such units have far greater significance in preventing pavement damage from overloading than an equal footprint area would have if concentrated at one or two locations."

An evaluation program by qualified persons to rate and tabulate the capacity of airfield pavements for different types of landing gear is suggested. "Pavement-thickness requirements for aircraft having dual wheels, also for those equipped with dual-tandems, need to be set forth in detailed, official form," the publication states.

A paper by Henry Aaron, CAA airport engineer, presented at an ASCE meeting last year, is cited as giving "promise that existing airfield pavements could support heavier aircraft if airplanes become equipped with multiple-wheel landing units. It was shown that a 12-in. flexible pavement on a good soil, adequate for single-wheel loads of only 60,000 lb (120,000 lb gross) would support 230,000 lb gross if airplanes were equipped with dual wheels, an increase of nearly 100 percent. However, this would be true only on good subgrades. He [Mr. Aaron] showed a 38-in. flexible pavement required on a poor soil for single-wheel loads of 60,000 lb (120,000 lb gross) would be good for gross loads of 145,000 lb, an increase of only 21 percent, when aircraft have dual wheels. This percentage-differential emphasizes the variation in good and poor soils to sustain numerous heavier loadings on dual wheels, even with substantial increase in pavement thickness.

"It was also shown that dual-tandems applied to 12-in. flexible pavements on a good soil sustain successfully gross loads of 450,000 lb, but only 60,000 (120,000 lb gross) when single wheels are used, an increase of 363 percent. Whereas 38-in. flexible pavements are required on poor soils for 60,000-lb single-wheel loads (120,000 lb gross), such pavements would be adequate for no more than 240,000 lb gross when dual-tandems are used. This shows an increase of only 100 percent is warranted —as against 363 percent on good soils— in using dual-tandems on poor soils, even on 38-in. pavement and foundation.

"No data showing increased capacities of rigid pavements when aircraft use multiple-landing gear were given. Nevertheless, it can be taken for granted their capacities would also be increased if planes use such equipment.

"Assuredly these findings warrant the CAA and aircraft manufacturers working together to explore and determine these matters as they affect design requirements in (1) Constructing new airfield pavements for all loadings, on all soil types, (2) utilizing existing airfield pavements to the fullest possible extent, and (3) keeping tires at relatively low pressures."

Army Engineers Restore Braelo Bridge in Greece

BRAELO BRIDGE (CALLED ALSO BRIDGE OF PAPADIA) AND TUNNEL, recently restored by Army Corps of Engineers after wartime devastation, is opened in formal ceremonies conducted by Col. D. W. Griffiths, M. ASCE, district engineer for Grecian District of Corps of Engineers. In past 20 months Colonel Griffiths has headed $29,000,000 program of reconstruction in Greece, which included building bridges on main lines of Greek State Railroad and Athens-Peloponnese Railroad. For his services to Greece he was recently decorated as Knight of Order of Phoenix (July issue, page 74). G. G. Werner, Jr., M. ASCE, who served as assistant project manager for Atkinson-Drake, on restoration of Greek projects, calls attention to fact that view of Braelo Bridge in destroyed condition, appearing on page 72 of May issue, was incorrectly designated Assopos Bridge, and that contractors on restoration of Gorgopotamus bridge (shown on same page) were Atkinson-Drake, of New York, and not Steers-Grove.

Quality Construction at Substantial Savings with

CONCRETE FRAMES AND FLOORS

CONCRETE frame and floor construction is ideally adapted to hospitals, apartments, schools, hotels, industrial plants and office buildings. It offers three important advantages of paramount interest to architects, engineers, owners and taxpayers:

1. It provides quality construction.
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Competitive bidding repeatedly has shown that concrete frames and floors can effect big savings in construction costs. Such savings are possible in tall buildings or in structures of six stories or less.

Maximum savings from concrete frame and floor construction can be achieved by observing the time-tested, easy-to-follow principles of quality concrete construction. This means designing the correct mix for the job, selecting the right materials for the mix, placing the mixture properly and curing the concrete adequately.

Applying the principles of quality concrete construction results in a mix that makes economical use of available materials, that is workable enough to be placed easily and quickly and that when hardened produces concrete with the strength to resist all static and dynamic loads.

Photo shows construction of Veterans Administration Hospital, Wilkes-Barre, Pa. The design utilizes reinforced concrete frame and concrete joist floors with concrete masonry fillers. The structure is approximately 46 ft. x 420 ft. and is 11 stories high. Kelly & Gruzer and Isadore Rosenfield, architects; Fred Severud, consulting engineer; and Merritt-Chapman & Scott Corporation, contractor, all of New York City.

For help in designing quality concrete write for a free copy of a 70-page illustrated booklet, *"Design and Control of Concrete Mixtures."* Booklet distributed only in United States and Canada.

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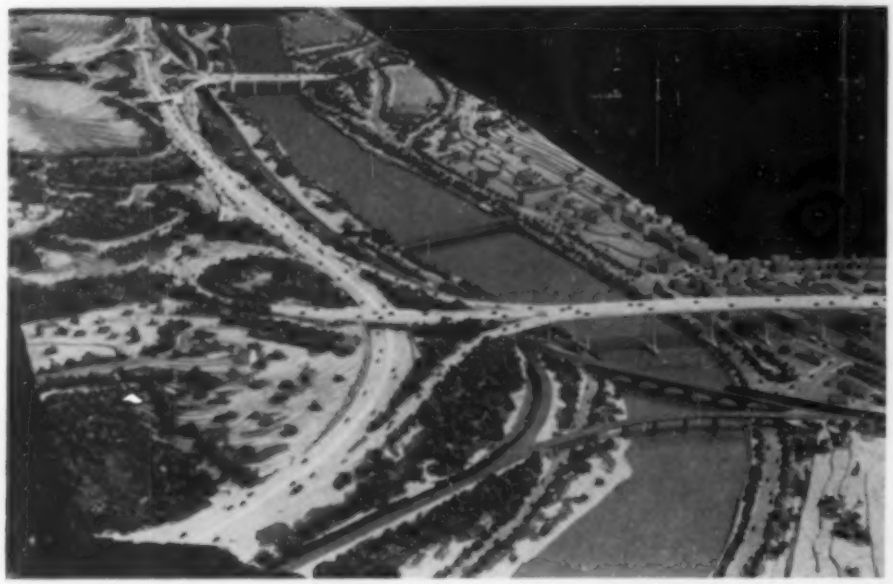
Schuylkill Expressway to Expedite Philadelphia Traffic



MODEL OF PROJECTED $50,000,000 SCHUYLKILL EXPRESSWAY, which will provide 10 miles of free-flowing highways within Philadelphia city limits, shows modified cloverleaf interchanges with City Line, Roosevelt Boulevard Extension, and Vince Street Extension. Part of Philadelphia City Planning Commission's six-year plan for highway construction, expected to total almost $100,000,000, Schuylkill Expressway will link up with eastern extension of Pennsylvania Turnpike now under construction. Preliminary plans for expressway are being prepared by New York City firms of Clarke, Rapuano & Holleran and Hardesty & Hanover.

Government Grants to Aid in Water Pollution Studies

PROVISIONAL GOVERNMENT GRANTS totaling $850,000 will be available to states wanting to undertake studies of water pollution resulting from industrial waste, according to an announcement from Federal Security Administrator Oscar R. Ewing. The allotment is part of a total of $2,200,000 appropriated by the present Congress to the Federal Security Agency to initiate the nation-wide program of prevention and control of water pollution called for in the Water Pollution Control Act passed last year.

Before funds can actually be released for study of industrial waste problems, applications setting forth specific programs must be submitted to the Public Health Service of the Federal Security Agency, Washington, D.C., for approval.

Papers Given at Large Dams Congress Available

PAPERS AND COMMUNICATIONS presented at the Third International Congress on Large Dams, held in Stockholm, Sweden, in June 1948, have been made available in limited supply by the U.S. Committee on Large Dams. Each three-volume set will consist of copies of 66 Reports and eight Communications concerned with one of the following subjects that were on the agenda of the congress: (1) Critical exposition of the measurement of uplift pressures and stresses arising therefrom; (2) research methods and instruments for measuring stresses and deformations in earth and concrete dams; (3) the most recent precautions to avoid the formation of pipings; and (4) experiences arising from the testing and actual use of special cements for large dams.

The sets of three bound volumes each will be sold in this country exclusively by the United States Committee on Large Dams at $40 each, prepaid. Shipping charges are included in the price. Sales will be conducted on a first-come, first-served basis.

Orders with accompanying checks or money orders should be addressed to the U.S. Committee on Large Dams, Gail A. Hathaway, chairman, 4316 Van Buren Street, University Park, Hyattsville, Md.

British Builders Inspect U.S. Construction Methods

A 17-MAN TEAM representing Great Britain's building industry arrived in New York on July 21 to start a six-week study of United States construction methods. The tour is sponsored by the Anglo-American Council on Productivity in cooperation with the Technical Assistance Division of the Economic Cooperation Administration. Other cooperating organizations are the Associated General Contractors of America and the American Institute of Architects, which are acting as joint hosts to the group during its stay in Washington.

Composed of architects, engineers, contractors, and workers, the team is studying American methods of constructing low and medium-cost houses, small schools, industrial plants, and commercial office buildings comparable in size to those in Great Britain. The group is particularly interested in methods of utilizing building materials other than lumber in the construction of houses. Methods of design, cost and procedures, and the manner in which owner, architect, engineer, and contractor cooperate to expedite construction are also being observed.

Meetings and Conferences

American Institute of Mining and Metallurgical Engineers. The Neil House in Columbus, Ohio, will be headquarters for a four-day meeting of the American Institute of Mining and Metallurgical Engineers, to be held from September 25–28, inclusive.

American Public Works Association. A four-day equipment show will highlight the American Public Works Association's 55th annual congress, to be held in Kansas City, September 18–21. Long-range public works planning will constitute the theme of the convention.

American Society for Testing Materials. Wood will be one of the principal materials discussed at a national meeting of the American Society for Testing Materials, to be held in San Francisco, October 10–14.

National Metal Exposition and Congress. The 31st national metal exposition is scheduled to be held in Cleveland, Ohio, October 17–21. Display headquarters for the exposition will be the Cleveland Public Auditorium.

National Safety Council. A meeting of the National Safety Council will be held at the Morrison Hotel, Chicago, Ill., September 24–28.

Pacific Coast Building Officials Conference. Pacific Coast building officials will hold their 27th annual business meeting at the Olympic Hotel, Seattle, Wash., September 20–23. Important committee meetings have been scheduled for September 19.

Positions Announced

New York City Civil Service Commission. At present there are vacancies in the New York City Housing Authority for positions as Superintendent of Construction, Assistant Superintendent of Construction, and General Superintendent of Construction, at salaries ranging up to $7,500 a year. These salaries include a cost-of-living adjustment of $350. The basic salary grade for all three positions is $3,000 per annum and over. Minimum experience requirements range from five to seven years, and written examinations and medical tests will be required for all three positions. Appointments by the New York City Housing Authority are exempt from the New York City residence requirements. Applications will be received by the New York City Civil Service Commission, 299 Broadway, New York 7, N.Y., between September 12 and 27.

ROADSIDE REPORT *by Bert Snooks, owner of the Texas Hauling Company, Houston, Texas, G.V.W. ratings for Ford F-7's and F-8's shown are 19,000 lbs. and 21,500 lbs. respectively.*

"The FORD BIG JOB is more rugged, in my opinion, than any other truck made!"

"I THINK the Ford 145-H.P. BIG JOB is the best all purpose truck on the market," reports Bert Snooks. "I am operating three Ford F-8's and four F-7's with eight-yard bodies. These seven BIG JOBS are doing a better job than fourteen 2-ton trucks with four-yard bodies that I operated in 1947. My Fords have from 15,000 to 100,000 miles and the cost of repairs has been negligible. The Ford BIG JOB is more rugged, in my opinion, than any other truck made."

In terms of *Payload-Performance* the Ford BIG JOBS have no equal in their class. No other truck offers so much payload capacity in relation to chassis weight, with as high a horsepower rating per gross ton. This means bigger payloads within legal load limits. It means faster, more profitable delivery of big loads. Ford's high *Payload-Performance* is evidence of Bonus Built construction. Each of over 150 Ford Truck models is Bonus Built . . . built extra strong to last longer.

ONLY THE FORD BIG JOB HAS ALL THESE FEATURES

- ★ New 145-h.p. Ford V-8 engine for top performance.
- ★ Ford concentric dual-throat carburetor for more power, more economy.
- ★ New heavy duty 5-speed transmissions—overdrive or direct-in-fifth—for operating flexibility.
- ★ Big Ford power-operated hydraulic brakes; front 16-inch by 2¼-inch; rear 15-inch by 5-inch double cylinder on F-7, 16-inch by 5-inch double cylinder on F-8. Air brakes also available for F-8.
- ★ Ford Super Quadrax single speed axles; two-speed axle available in Model F-8.
- ★ Large diameter (10-inch) wheel bolt circle with 8 studs to allow for extra-strong hub construction.
- ★ Million Dollar Cab with Ford Level Action suspension for greater driving comfort.
- ★ Nationwide service from over 6,400 Ford Dealers.
- ★ Ford Bonus Built construction for long truck life.

Gross Vehicle Weight ratings: F-8 up to 21,500 lbs., F-7 up to 19,000 lbs. Gross Combination ratings: F-8 up to 39,000 lbs., F-7 up to 35,000 lbs.

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USING LATEST REGISTRATION DATA ON 6,106,000 TRUCKS, LIFE INSURANCE EXPERTS PROVE FORD TRUCKS LAST LONGER!

U.S.B.R. Announces Large Western Construction Projects

IN ITS *Advance Construction Bulletin* for August 1, the Bureau of Reclamation lists projected Western construction projects under the head of "Bid Calls Expected This Month." As usual, the Bureau reminds contractors that the announcements are for information only and are not to be construed as invitations to bid. Projects listed include the following:

TECOLOTE TUNNEL AND ACCESS ROAD

Santa Barbara, California

Location: Near Goleta, Calif.

Work: Bids for construction of the 7-ft-dia Tecolote Tunnel are to be invited under the following alternate plans:

Plan 1: Bids will be accepted on either or both of the following schedules:

Schedule (1) Excavation for first 5,600 ft at inlet end of tunnel.

Tunnel excavation	12,400 cu yd
Road and structures excavation	9,800 cu yd
Furnishing and installing steel tunnel supports	222,000 lb
Furnishing and erecting timber tunnel supports	160 Mbm

Schedule (2) Excavation for last 5,600 ft at outlet end of tunnel and construction of access road.

Road and structures	74,200 cu yd
Tunnel excavation	12,100 cu yd
Furnishing and installing steel tunnel supports	147,000 lb
Furnishing and erecting timber tunnel supports	105 Mbm

Plan 2: Schedule (3) All work covered by Schedules (1) and (2) and excavation for the remaining 11,200 ft of tunnel, concrete lining, and structures for the entire 6.4 miles of tunnel

Road and structures excavation	84,000 cu yd
Tunnel excavation	74,000 cu yd
Concrete	21,000 cu yd
Furnishing and installing steel tunnel supports	1,020,000 lb
Furnishing and erecting timber tunnel supports	732 Mbm
Furnishing and placing reinforcing steel	75,000 lb

Time Allowed for Completion: Schedules (1) and (2) 365 days; Schedule (3) 1,400 days.

TRACY SWITCHYARD COMPLETION

Central Valley Project, California

Location: Alameda County, about 9 miles northwest of Tracy, Calif.

Work: Completion of Tracy switchyard, including construction of control building, transformer transfer track, tunnels and duct banks; erection of steel switchyard structures and switchyard fence; installation of pumps and compressor, electrical equipment, and water distribution, sewage disposal, drainage, and air-conditioning systems; and assembly of hoist and transfer car.

Excavation	45,500 cu yd
Compacted backfill	45,000 cu yd
Backfill	15,300 cu yd
Furnishing and handling cement	7,700 bbl
Furnishing and placing reinforcing steel	915,000 lb
Concrete	5,700 cu yd
Erecting structural steel	915,000 lb
Installing cable and cable tray supports, oil storage tanks, and metalwork	280,000 lb
Installing metal pipe less than 6 in. in diameter	60,000 lb
Installing metal pipe 6 in. or greater in diameter	92,000 lb
Installing asbestos - cement pipe less than 8 in. in diameter	17,000 lb
Installing asbestos-cement pipe 8 in. or greater in diameter	102,000 lb
Installing 29 oil circuit breakers	400,000 lb
Installing 13 auto-transformers	1,663,000 lb
Furnishing and installing conduit	50,500 ft
Installing copper, control, and coaxial cable and conductor	229,000 ft
Assembling and installing synchronous condenser	480,000 lb
Installing 109 disconnecting switches	237,200 lb

Time Allowed for Completion: Work for operation of pumping plant units 5 and 6, 500 days; all remaining work, 560 days.

LATERALS

Missouri River Basin Project, Nebraska

Location: About 35 miles northeast of McCook, Nebr.

Work: Construction of earthwork and structures for about 20 miles of the Cambridge lateral system. Maximum capacity of the unlined laterals is to be 30 cfs.

Excavation	92,000 cu yd
Compacted embankment	51,000 cu yd
Concrete	900 cu yd
Concrete pipe	4,830 ft
Furnishing and installing gates, hoists, and miscellaneous metalwork	18,900 lb

Time Allowed for Completion: 390 days.

ROAD RELOCATION

Palisades Project, Idaho

Location: 56 miles southeast of Idaho Falls, Idaho.

Work: Relocation of Forest Service road from Snake River to McCoy Creek and construction of Palisades Dam access road.

Excavation	113,000 cu yd
Furnishing and laying 6- to 60-in. diameter pipe	6,400 ft

Time Allowed for Completion: 360 days.

NEW IN Education

FLORIDA'S 17TH ANNUAL Short Course for Water and Sewage Treatment Plant Operators, held on the University of Florida campus this summer, enrolled 160 persons from 51 towns and five states. Operators were given a 40-hour course of instruction divided equally between conferences on fundamentals and individual laboratory training. Dr. A. P. Black, professor of chemistry at the university and recently elected president of the American Water Works Association, headed the faculty for the advanced water treatment section, and C. D. Williams, M. ASCE, head of the civil engineering department, was in charge of the sewage-treatment section. Achievements of water and sewage-treatment groups all over the country were summarized in the leading talk at the opening session by V. M. Ehlers, M. ASCE, director of the Bureau of Sanitary Engineering of the Texas State Department of Health.

* * * *

COLUMBIA UNIVERSITY engineering students enrolled in city planning and housing courses spent part of June in Puerto Rico, studying its program of slum clearance, low-cost housing, and urban planning.

* * * *

YALE UNIVERSITY WILL conduct a regional Institute for Traffic Training, September 6–16, in cooperation with the National Committee for Traffic Training. Courses will include study of Accident Records and Their Uses; Driver Education and Training; Pedestrian Protection; and Traffic Engineering. There will also be a seminar on public support. The institute at Yale will be the last of the 1949 regional series. Previous institutes were held this year at the University of California, New York University, and Northwestern University.

* * * *

ENGINEERS AND DOCTORS will join forces to study problems of industrial health in September, when New York University inaugurates a course in industrial hygiene. The new course—to be offered cooperatively by the College of Engineering and Institute of Industrial Medicine of the NYU-Bellevue Medical Center—will be open to physicians and to engineers holding bachelor degrees in sanitary, chemical, mechanical, or civil engineering. Scheduled to begin on September 26, the new course will consist of nine months of didactic teaching and three months of in-plant work. Further information may be obtained from the Dean, New York University College of Engineering, Bronx 53, New York, or from the Dean, New York University Postgraduate Medical School, 477 First Avenue, New York 16, N.Y.

* * * *

A SCHOOL FOR water-plant operators and superintendents will be held at Pennsylvania

Arc Welding Cuts Construction Costs 20% on World's Largest Harbor Shed

Fig. 1. Field welding truss sections to fabricate 200-foot span rigid frame, using 300-amp. Lincoln "Shield-Arc" Engine Driven Welders. Sections are lined up with a transit and tack welded prior to finish welding.

Fig. 2. All welded rigid frame Harbor Shed at Long Beach, California. Designed by R. D. Sandham under direction of R. R. Shoemaker, Chief Engineer, and R. J. Amar, Port Manager. Steel fabricated and erected by Pacific Iron and Steel Company of Los Angeles.

SIMPLER, faster construction made possible by arc welding, accounts for an estimated 20% saving in structural cost of the Harbor Transit Shed at Long Beach, California. Built entirely with arc welding, this 2,625-ton rigid frame structure was erected in only 90 days with a 32-man erection crew. By eliminating rivets and gusset plates, designers cut the structural weight by more than 7%, creating the world's largest unobstructed single span harbor shed—1,200 feet long, with a 200-foot span and 40 feet high.

The 32 rigid frames used were shop fabricated in 30 working days using flame cut steel plate and standard rolled shapes. Seventy per cent of the arc welding was finished in the shop using fast, simple downhand welding techniques. Forty-foot sections thus fabricated were then trucked to the erection site for field welding.

Erecting operations were so planned that the 32-man crew could raise and connect the trusses with the I-beams at a rate of 8 frames in a six-hour shift, an erection speed considered impossible with riveted construction. Three 20-ton cranes raised the field-assembled 50-ton all-welded rigid frames, holding them in position while connecting I-beams and trusses by arc welding with 200-amp. Lincoln "Shield-Arc" Engine Driven Welders.

The unique Long Beach Harbor Transit Shed is built to withstand earthquakes. Each rigid frame rests on a 5-inch diameter hardened pin, thus compensating for any light movement or settling that might occur in the harbor area.

Fig. 3. Shop fabricating truss sections, using "Automatic Lincolnweld." Fillet welds are made in single pass at 600 amps. and speed of 24 inches per minute.

Fig. 4. Hip girder connection to base plate. Five-inch diameter horizontal pin allows free movement in case of earthquake or settling in harbor area.

Fig. 5. Welding truss to hip girder. Butt joints are completed with ten passes on flange plate and two passes on web plate.

The above is published by **THE LINCOLN ELECTRIC COMPANY** *in the interests of progress.*

Architects and engineers are invited to write on their letterheads to be placed on mailing list for Structural Welding Studies.

The Lincoln Electric Company, Dept. 144, Cleveland 1, Ohio.

State College, State College, Pa., September 19–23, under the direction of the Sanitary Engineering Division of the college. Sponsoring organizations are the Pennsylvania Department of Health and the Pennsylvania Water Works Operators' Association. Since registrations are limited, early application is urged. Programs, application blanks, and other information can be obtained from the Sanitary Engineering Division at the college, and advance registration can be secured by writing to Central Extension, the Pennsylvania State College. The registration fee is $20.

R. Robinson Rowe, M. ASCE

"Well, Joe, did or didn't you?"

"Did or didn't I what?"

"You know precisely what," countered the Professor.

"Oh, that!" said Joe Kerr. "No, I didn't, because it was silly. You asked which one of 12 members of a tri-star truss should be left out; well, I'd leave 5 out, the upper-right 5, and have a more efficient semi-tri-star truss."

"Don't let Joe kid you," chortled Cal Klater. "He didn't even know how to get a wrong answer. I used the method of least work, that is, I let x be the stress in BF, computed the stress in all members in terms of x, computed the work done in each member by its stress, and solved for x to make a minimum of the total work done on the frame. The work for any member is half its elongation times its stress, or $Fl/2AE$, and since A and E are constants for this frame and F is of the form $ux + s$, the work is:

$$W = k \sum l\,(ux + s)^2$$

and will be least when $dW/dx = 0$, or

$$2k \sum x(lu^2x + lus) = 0$$

$$x = -\sum lus / \sum lu^2$$

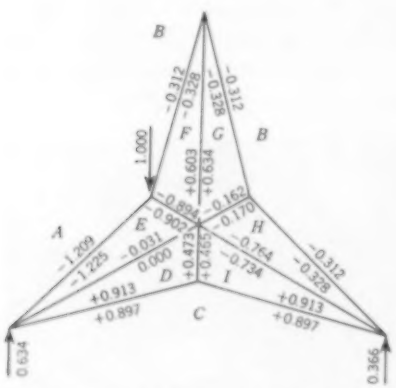

FIG. 1. TRI-STAR STRESS before and after slotting "DE"

TABLE I

Mb	l	u	s	lus	lu^2	$ux + s$
AE	0.52	1.00	−0.90	−0.47	0.52	−1.21
BF	0.52	1.00	0	0	0.52	−0.31
BG	0.52	1.00	0	0	0.52	−0.31
BH	0.52	1.00	0	0	0.52	−0.31
CI	0.52	1.00	1.22	0.63	0.52	0.91
CD	0.52	1.00	1.22	0.63	0.52	0.91
DE	0.58	−1.93	−0.63	0.70	2.16	−0.03
FG	0.58	−1.93	0	0	2.16	0.60
HI	0.58	−1.93	−1.37	1.53	2.16	−0.76
EF	0.15	0.52	−0.73	−0.06	0.04	−0.89
GH	0.15	0.52	0	0	0.04	−0.16
DI	0.15	0.52	0.63	0.05	0.04	0.47
Totals				3.01	9.72	

"Table I is all there is to it. Totals of the summations give $x = -3.01/9.72 = -0.31$ and this is substituted to find the stresses in the last column. Then it's pretty obvious that DE is hardly stressed at all and can be left out without affecting the other members much."

"And in this case the obvious is so, Cal, as the before-and-after stresses on Fig. 1 will show. Joe's plan would have raised the stress in HI to 1.342. For the purists, I will add that all stresses can be expressed in surds, that in DE being $\frac{1}{42}(24\sqrt{3} - \sqrt{6} - \sqrt{2} - 39) = -0.03082104$. I like the problem because few will guess that DE is ineffective and BF in compression. Now Guest Professor Canby Dunn will show you a perplexing diversion."

"Involving absolute differential reduction, Noah, of this sort:

20	34	25	44
14	9	19	24
5	10	5	10
5	5	5	5
0	0	0	0

in which the first line of numbers is reduced to zeros in four steps, each being an absolute differencing of adjacent numbers (the last being 'adjacent' to the first). On four coterminal highways, A, B, C, D, the numbers of accidents in 1948 were a, b, c, d. The Safety, Traffic and Design Highway Engineers have devised a system of progressive highway improvement and traffic redistribution which, they hope, will reduce the accident toll annually by absolute differentiation until it becomes zero in 1968. How many accidents must there have been in 1948?"

[Cal Klaters were: Ed C. Holt, Stoop (John L.) Nagle, Richard Jenney, Anne Othernut (who included polygons for all possible redundancies), and Marvin A. Larson (who also sent a solution of June's equator-to-equator flight problem from a Fairbanks viewpoint). Prof. Canby Dunn is D. B. Steinman.]

NEWS OF Engineers

James H. Stratton, brigadier general, Army Corps of Engineers, joined the Knappen, Tippetts, Abbett Engineering Co., of New York City, as a special partner, following his retirement as division engineer of the New England Division of the Corps of Engineers on July 31. General Stratton is holder of the Legion of Merit and the Distinguished Service Medal for his services in World War II as chief of the Engineering Branch of the Construction Division, Corps of Engineers, and assistant chief of staff, G-4 Headquarters, European Theater. Prior to the war, General Stratton had many assignments on river and harbor work, including the position of district engineer on the construction of Conchas Dam in New Mexico and Joe Martin Dam in Colorado. With the Knappen, Tippetts-Abbett organization, he will continue his work in river, harbor and flood control engineering.

James H. Stratton

Dean F. Peterson, Jr., previously professor of civil engineering and irrigation at Utah State College, has been appointed to head the civil engineering department at Colorado Agricultural and Mechanical College. He will also serve as director of the civil engineering section of the Colorado Agricultural Experiment Station.

Wallace E. Belcher, of Philadelphia, Pa., received the honorary degree of doctor of engineering from the University of Maine during the current commencement season.

John A. Bonell has accepted the position of assistant professor of civil engineering at the University of Nevada for the school year beginning in September. Mr. Bonell was formerly structural designer for the Quinton Engineers, Ltd., of Los Angeles, and during the war served in the Army Corps of Engineers with the rank of major.

James B. Diven, Jr., until recently with the Foster Wheeler Corp., is now affiliated with the Sauer Co., mechanical contractors of Pittsburgh, Pa., and Columbus, Ohio. Mr. Diven will be heating engineer in the Columbus office.

Douglas Jones has been appointed manager of the Salt Lake City district office of the Chain Belt Co., of Milwaukee. He will operate his business as the Douglas Jones Co., at 1551 Redondo Avenue, Salt Lake City.

Charles E. Smith retired on August 1 as vice-president, Purchases and Stores, of the New York, New Haven & Hartford Railroad Co. after nearly 25 years of service.

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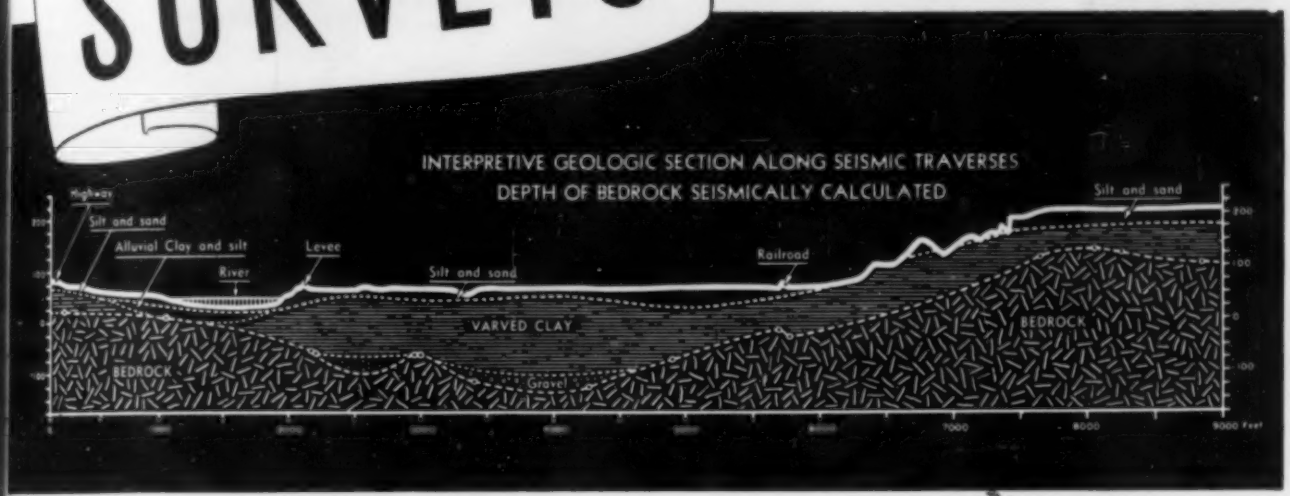
A practical and economical means of securing information on sub-surface conditions for construction projects



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Col. Clark Kittrell, division engineer for the Upper Mississippi Valley Division at St. Louis, Mo., has announced his retirement from active duty, effective in the fall.

Clark Kittrell

Much of Colonel Kittrell's career has been devoted to heavy construction in connection with river and harbor and flood control work, and he expects to continue in the heavy construction field. His army service has included assignments as district engineer on the construction of Fort Peck Dam, district engineer for the New Orleans and Panama Engineer Districts, and division engineer for the Middle Atlantic Division at Baltimore. During the war he was overseas as engineer and deputy chief engineer in the communication zone of Africa, Italy, and France.

John G. Duba, of Newport, R.I., has been appointed instructor in civil engineering at Illinois Institute of Technology. During the past school year Mr. Duba was an instructor in the University of Missouri School of Mines and Metallurgy, while completing work toward a master's degree.

Thorndike Saville, dean of engineering at New York University and former ASCE Director, was elected president of the American Society for Engineering Education at the recent annual convention of the organization in Troy, N.Y. Newly elected vice-presidents of the organization are B. J. Robertson, H. H. Armsby, and F. E. Terman. F. M. Dawson, dean of engineering at the State University of Iowa, continues as vice-president in charge of ASEE's Engineering College Research Council, and James S. Thompson was reelected treasurer of the organization.

Emerson C. Itschner, colonel, Army Corps of Engineers, has assumed new duties as district engineer of the Seattle District. Since May 1946 he has been chief of construction operations, Division of Military Construction, in the Office of the Chief of Engineers, Washington, D.C. As chief engineer of the Advance Section, Communications Zone in Europe, during the recent war, Colonel Itschner was responsible for heavy construction in the invasion areas of France. He was also responsible for planning the reconstruction of the Port of Cherbourg and for the rehabilitation of public utilities in the American sector of northern France, Belgium, Luxembourg, and Germany.

Elmer P. Haw is retiring from government service in the Panama Canal after 22 years with the Panama Canal and the Panama Railroad Co. Most recently he has been building engineer for the Construction Quartermaster Department. A resident of the Canal Zone for 39 years, Mr. Haw was at one time engaged in business in the Republic of Panama. He expects to settle in the vicinity of Seattle, Wash.

Clarence J. Velz has resigned as head of the civil engineering department at Manhattan College in order to accept an appointment to head a new department of public health statistics at the University of Michigan. Professor Velz has headed the civil engineering work at Manhattan College for the past eleven years and has been active as a private consultant on river pollution.

Jonathan E. Teal has established a consulting practice in Richmond, Va. Widely experienced in the economics of railway location and operation and other phases of railroad engineering, Mr. Teal will specialize in railway operating and transportation studies relating to Interstate Commerce Commission rate investigations.

John McGowan, Denver engineer, has been elected vice-president of the Colorado Engineering Council. He was formerly secretary-treasurer of the organization. Established in 1919, the Colorado Engineering Council is one of the oldest engineering councils in the United States. It incorporates 19 technical and professional societies, and represents some 3,000 engineers in the state.

Merton J. Willis has resigned from the Cornell University engineering staff to accept an appointment as assistant professor of civil engineering at Swarthmore College. **Charles W. Newlin** has been appointed instructor in civil engineering at Swarthmore. He has just completed work for the degree of master of science in engineering at Harvard University, where he specialized in soil mechanics. Both are veterans of the Army Corps of Engineers.

CHARLES S. WHITNEY (ABOVE RIGHT) receives first annual award of Concrete Reinforcing Steel Institute from Henry C. Turner, Jr., president of Turner Construction Co., at recent 25th anniversary meeting of the Institute held at White Sulphur Springs, W.Va. Mr. Whitney accepted the award in behalf of the firm of Ammann & Whitney, consulting engineers of New York and Milwaukee, for its paper entitled "Thin Shell Concrete Structures." Mr. Turner was one of a three-man judging committee, who selected the Ammann & Whitney paper as best submitted in the Institute's 1949 competition for "noteworthy contributions to the advancement of reinforced concrete construction."

Joseph Marin, professor of engineering mechanics at Pennsylvania State College, received the George Westinghouse Award of the American Society for Engineering Education at the recent annual meeting of the organization in Troy, N.Y. Professor Marin was cited "for his effective contributions to the training of graduate and undergraduate students in the field of applied mechanics; for important contributions through research, to knowledge of the applications of principles of mechanics to the uses of engineering materials; for his many scientific and technical articles which have brought the results of experimental researches within reach of practicing engineers; and for his painstaking efforts to develop better teaching materials in the form of textbooks, class notes, problems, and laboratory equipment."

Joseph Marin

N. T. Veatch, partner of the late **E. Black,** Past-President of the Society, in the Kansas City, Mo., consulting firm of Black & Veatch, announces that the firm is continuing with the same name and personnel. Mr. Veatch writes that, "The policies of the firm, which have been established during the past 40 years, will remain unchanged."

Ford Kurtz was recently elected vice-president in charge of engineering for the J. G. White Engineering Corp. He is also a director of the company and since 1946 has served as engineering manager and chief hydraulic engineer.

Frank T. Tobey, Jr., announces that he has opened his own office for the practice of structural engineering in the Falls Building, Memphis, Tenn. During the war Mr. Tobey served in the Army Air Corps.

James M. Robbins, executive associate in the Newark College of Engineering civil engineering department, was recently promoted to the rank of full professor. Professor Robbins has been on the Newark College staff for the past 20 years. During the war he did research work for the Army Ordnance Department.

Francis E. Twiss is now director of planning and economics for the International Road Federation, Washington, D.C. Until recently Mr. Twiss was highway specialist for the Transportation and Communications Department of the Chamber of Commerce. He was in the Navy Civil Engineer Corps during the war, attaining the rank of lieutenant commander.

Milton F. Wagnitz has been promoted to the position of assistant city engineer, Detroit, Mich. In the City Engineer's Office for more than 25 years, Mr. Wagnitz had charge of the design of Detroit's $[illegible] 000,000 sewage treatment plant and the current $45,000,000 sewer-relief program. While on leave of absence during the war he served as a lieutenant colonel in the Engineers Corps overseas.

Cast Iron Pipe!

SERVES FOR CENTURIES

Sidney T. Harding, professor of irrigation at the University of California for the past 35 years, has retired. He is currently serving a term as Director of the ASCE.

J. S. Bright recently retired as deputy commissioner of the Bureau of Public Roads after 32 years of service with the organization. He has been senior highway engineer in the Bureau's regional offices at Portland, Ore., and Missoula, Mont., and chief construction engineer in the Western headquarters office at San Francisco. Later he was sent to Honolulu, where he organized a Bureau office and initiated the planning and construction of the islands' road system. He was appointed deputy commissioner in 1944. Mr. Bright will live in San Bernardino, Calif.

Randolph P. Hoelscher, who has been in charge of the College of Engineering Sciences at the University of Illinois, Chicago Undergraduate Division, since its establishment in October 1946, will return to the Urbana campus of the university as head of the department of general engineering drawing. Prior to his appointment to head engineering at the Navy Pier school, he had been a member of the Urbana faculty for 28 years. Professor Hoelscher will be succeeded at the Navy Pier School by **Frederick W. Trezise,** who will go to Chicago from the University of Illinois division at Galesburg.

Leonard B. Gallagher, retired army colonel, has been appointed manager of the Maritime Association of the Boston Chamber of Commerce. Colonel Gallagher's army service included a period as district engineer and division engineer of the New England Division.

W. R. Rogers, lieutenant in the Navy Civil Engineering Corps, is now stationed at the Naval Arctic Testing Station at Point Barrow, Alaska.

Walter E. Stoddard, of Sacramento, Calif., recently retired from the California Division of Water Resources after 35 years of service. He plans to devote his time to his hobby of collecting rare books.

A. B. Cohen, New York City consultant, is the recent recipient of the degree of doctor of engineering from his alma mater, Purdue University.

Deceased

Robert Livingston Allen (Assoc. M. '08) of Buffalo, N.Y., died on July 5, at the age of 73. Beginning in 1902, Mr. Allen was for many years with the Archbold-Brady Co., engineers and contractors, of Syracuse, N.Y., which he served on a variety of upstate New York construction projects. Later he was engineer for the Lackawanna Steel Construction Corp., in Buffalo, and more recently had been production engineer for the General Engineering Co., Buffalo.

William Hugh Coverdale (M. '11) a member of the New York City consulting firm of Coverdale & Colpitts since 1913, died in a hospital there on August 10. He was 78. An industrialist as well as an engineer, Mr. Coverdale was also president and chairman of the board of American Export Lines, head of the Canada Steamship Lines, and president and director of many other organizations. A Canadian by birth, he graduated from Geneva College, Beaver Falls, Pa., in 1891. The next ten years were spent with the Pennsylvania Railroad, and in supervising construction of the Westinghouse plants in East Pittsburgh. In 1904 he founded the firm of William H. Coverdale & Co., predecessor of the Coverdale & Colpitts organization. During World War II, he was president of the Maple Leaf Fund, organized to aid the Canadian and British war effort. Mr. Coverdale's many affiliations included the American Institute of Consulting Engineers, and the University, Metropolitan, and Engineers' Clubs of New York.

Blackstone Studios, Inc.

W. H. Coverdale

Henry Frederick Dosé (M. '04) of St. Louis, Mo., died on July 7, at the age of 84. Born in Poland, Mr. Dosé was educated at the University of Illinois and did his engineering work in this country and for American firms in South America, Alaska, and Canada. He had also been in Panama with the Isthmian Canal Commission, and at one time was with the U.S. Board of Engineers on Deep Waterways.

M. Ward Easby (M. '97) construction engineer of Philadelphia, Pa., died recently at the age of 84. A graduate of Rensselaer Polytechnic Institute, class of 1886, Mr. Easby's early engineering experience included work on the design and construction of the Thames River Bridge at New London, Conn., and on bridge design for A. P. Boller, of New York. He was also assistant engineer for the Cambria Iron Co., at Johnstown, Pa. Since 1895 Mr. Easby had maintained a consulting and construction practice in Philadelphia—for many years under the name of M. Ward Easby, Inc. A few years ago he retired as president of the organization. Mr. Easby's firm supervised the design and construction of many notable office and industrial buildings in Philadelphia as well as some of the buildings on the University of Pennsylvania campus.

Arthur Ellwood (Assoc. M. '42) civil engineer in charge of port and harbor work for the Knappen Tippetts Abbett Engineering Co., of New York, died in a hospital there on July 20. His age was 40. In the recent war, Mr. Ellwood was a lieutenant commander in the Navy Civil Engineer Corps, serving in the Admiralty Islands in the Pacific as civil engineer and dock control officer on the construction of advance-base floating dry docks. Since the war he had been with the Knappen Tippetts Abbett Co. on engineering projects in various parts of the world including Greece, where he was in charge of his firm's work in the reconstruction of the Greek ports and the Corinth Canal. More recently he made engineering studies on a Delaware River port development plan and reported to the city of Tel Aviv, Palestine, on plans for a deep-sea port.

Celso Augusto Garcia (Assoc. M. '28) of Santurce, Puerto Rico, died in February, according to word just received at Society Headquarters. He was 58. Mr. Garcia had been engaged on numerous local engineering projects, including construction of the Central San Louis & Santo Domingo Railroad and of Guajataca Dam. Later he served for a number of years as general manager of the Plata Sugar Co., at San Sebastian, Puerto Rico.

Harold Gatow (Jun. '40) of Los Angeles, Calif., died recently. He was 30 and an alumnus of the University of California, class of 1940. Since his graduation Mr. Gatow had been an assistant engineer in the U.S. Engineer Office at Los Angeles.

Frederic Robert Harris (M. '10) New York City consultant and retired rear admiral in the Navy Civil Engineer Corps, died in a New York hospital on July 20. He was 74. Commissioned in the Navy Civil Engineer Corps in 1903, Admiral Harris filled a variety of Navy posts at the Charleston, New York, and Philadelphia Navy yards and at Pearl Harbor. During World War I, he served as chief of the Bureau of Yards and Docks and as manager of the Emergency Fleet Corp. Since his retirement from the Navy in 1927, he had been president of the New York consulting firm of Frederic R. Harris, Inc. An authority on graving docks, floating docks and similar structures, Admiral Harris served as consultant to the Navy in World War II. He designed the world's largest floating dry docks, capable of lifting 100,000 tons, which were of tremendous value in the war in the Pacific. He was a member of many professional societies and widely known as a philatelist.

Frederic R. Harris

Beaudric LaFitte Howell (Assoc. M. '21) consulting engineer and vice-president and director of the Chevy Chase Land Co., Washington, D.C., died on June 24, at the age of 62. A lifelong resident of Alexandria, Va., Mr. Howell received his civil engineering degree from the University of Virginia. He then became a partner in his father's firm, David J. Howell & Son, taking over the firm upon his father's death in 1927. In the same year he became a consulting engineer for the Chevy Chase Land Co., which helped to develop the Chevy Chase, Md., area, and for the past ten years had been vice-president and director of the organization. Mr. Howell was a lieutenant in the Army Corps of Engineers in World War I.

Water Pressures are UP in Longview

The pressure in the water system at Longview, Texas, is definitely improved since the city has recently added 1,000,000 gallons of elevated storage capacity in its water system. Before the 1,000,000-gal. tank shown above was installed, Longview relied on two elevated tanks with a total capacity of 350,000 gals. of water.

Longview is another of the progressive cities that have expanded their elevated storage facilities after having experienced the benefits of gravity water pressure. This trend is continuing because elevated storage generally offers: uniform water pressure during peak loads; adequate reserve supply during power failure; lower pumping costs; increased capacity of water system; and lower fire insurance rates.

The radial-cone bottom design of tank, as shown above, is particularly well adapted to large capacities. It provides a lower range in head for comparable capacities than tanks of smaller diameter. Hence, the pumps are working against a lower average head, which reduces pumping costs.

Horton welded steel tanks are available with radial-cone bottoms in capacities from 500,000 to 2,500,000 gals.; and with ellipsoidal bottoms from 15,000 to 500,000 gals. Write our nearest office for complete details about them.

Above: 1,000,000-gal. Horton radial-cone bottom tank at Longview, Texas. There are also two Horton ellipsoidal-bottom tanks, with a total capacity 350,000 gals., in the system.

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Los Angeles 14..1556 General Petroleum Bldg.
New York 6..3395—165 Broadway Bldg.
Philadelphia 3,.1652-1700 Walnut St. Bldg.
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San Francisco 11...1284-22 Battery St. Bldg.
Seattle 1.....1309 Henry Bldg.
Tulsa 3.....1647 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

Constantin Denis Kaminsky (M. '48) civil engineer for the New York City Board of Water Supply, died on May 24 at the age of 59. Born in Russia, Mr. Kaminsky graduated from the Imperial Institute of Civil Engineers in St. Petersburg and spent his early career on engineering projects in Russia and Yugoslavia. Coming to the United States in 1924, he was employed, successively, by the Erie Railroad, the New York Central, and the New York City Health Department. From 1934 to 1937 he was designing engineer at the New York Merchant Marine Academy, Fort Schuyler, N.Y., and since 1938 he had been with the New York City Board of Water Supply as a civil engineer in Design Division I, except for a period of voluntary war service. During this period, Mr. Kaminsky went to Fort Richardson, Alaska, under the War Department to design a water supply system for the army base there.

C. D. Kaminsky

John Robert Haswell (M. '39) professor in charge of the Agricultural Engineering Extension at Pennsylvania State College, died in Philadelphia on July 30. Professor Haswell, who was 62, attended the Baltimore Polytechnic Institute and graduated from Cornell University in 1909. In the following year he accepted a position as drainage engineer with the U.S. Department of Agriculture, where he remained until 1920 when he joined the extension staff at Pennsylvania State College. A veteran of World War I, in which he served as a captain in the Corps of Engineers, Professor Haswell was active in the American Legion. At the time of his death he was ASCE Contact Member for the Student Chapter at Penn State.

Francis Roderick MacLeay (M. '45) chief engineer and general project manager for John A. Johnson & Sons, a Brooklyn, N.Y., contracting company, died in New Rochelle, N.Y., on July 20. He was 52. Until recently Mr. MacLeay was chief engineer for the Corbetta Construction Co., of New York, and earlier he had a consulting practice in partnership with George E. Strehan. Mr. MacLeay had served as consultant or designer on numerous New York City public housing projects and on the George Washington, Triborough, Bronx-Whitestone, and Henry Hudson bridges in New York. Holder of degrees from the engineering school of Northeastern University and the Suffolk Law School in Boston, Mr. MacLeay was author of two engineering texts on structural subjects. He belonged to the American Concrete Institute and the Boston Society of Civil Engineers, and was vice-president and a former president of the Consulting Structural Engineers Society of New York.

Ernest James Theodore Manchester (M. '10) of Brisbane, Queensland, Australia, died on April 8, at the age of 79. A native of Australia, Mr. Manchester was educated at Melbourne University and spent his engineering career in that country. For some years he was with the Melbourne and Metropolitan Board of Works, and from 1910 until his retirement in 1933 he was president and chief engineer of the Metropolitan Water and Sewerage Board of Brisbane.

Hiram Bloom Mann (Jun. '43) of Hackensack, N.J., died on March 23, at the age of 28. A graduate of Bucknell University with the bachelor of science degree in 1943, Mr. Mann had been with the Brewster Aeronautical Corp., at Hackensack, and more recently was in the army.

Linwood G. Mort (M. '48) a partner in the New Haven, Conn., consulting engineering firm of Argraves & Mort, died at his home in Guilford, Conn., on July 4. Mr. Mort, who was 40, was also director of the Real Assets Division of the Connecticut Comptroller's office. A civil engineering graduate of Rensselaer Polytechnic Institute in 1934, Mr. Mort became town engineer for Griswold, Conn., in 1936, and later was vice-president of Haller Engineering Associates, Cambridge, Mass. In 1943 he organized the consulting firm of Argraves & Mort.

Noble Lewis Owings (Assoc. M. '39) assistant to the chief engineer of the Washington Suburban Sanitary Commission, Hyattsville, Md., died on June 24, at the age of 59. An engineering graduate of Johns Hopkins University, Mr. Owings spent his early career with the Baltimore & Ohio Railroad. Since 1919 he had been connected with the Washington Suburban Sanitary District, which he served in a variety of capacities. In World War I, Mr. Owings was a lieutenant in the Army Corps of Engineers.

Wilfred Lewis Painter (M. '46) commodore, Navy Civil Engineer Corps, was killed in an explosion aboard a yacht in the Potomac River at Washington, D.C., on July 10. His age was 40. Entering the Navy Civil Engineer Corps in 1941, Commodore Painter was officer in charge of salvage of the *U.S.S. California* sunk at Pearl Harbor, and later was staff commander for the Pacific Fleet. On terminal leave since October 1945 he had been employed as engineer by the Pacific Bridge Co., and more recently was chief design engineer for Atkinson & Drake in Greece and other countries. Early in his career Commodore Painter was with the Texas Oil Co. in Shanghai, China.

James Rush Rhyne (M. '22) consulting engineer of Little Rock, Ark., died on July 12, at the age of 68. An alumnus of the University of Arkansas, with the degrees of B.S. and B.C.E., Mr. Rhyne later graduated from the Arkansas Law School with the L.L.B. degree. After an early career in railroad work, he established an engineering firm in eastern Arkansas, which specialized in drainage and flood control work. Later he was director of highways for the state, and in World War II he served as project engineer in the establishment of Japanese relocation camps under the War Relocation Authority. Since the war Mr. Rhyne had conducted a general civil engineering practice as head of the Rhyne Engineering Co. Active in the field of professional registration, Mr. Rhyne was a past-president of the National Council of Engineering Examiners, the Arkansas Board of Engineering Examiners, and the Arkansas Society of Professional Engineers.

Benjamin Franklin Wade (M. '44) died suddenly at his home in San Francisco, Calif., on May 31, at the age of 60. Long identified with the redwood lumber industry, Mr. Wade had been consulting engineer for the California Redwood Association since 1936. He was a graduate of the Stanford University engineering school and served with the Army Engineers in World War I, leaving active duty with the rank of major. Between that time and his appointment to the staff of the California Redwood Association, Mr. Wade was a sales engineer for the Pacific Lumber Co., helping to pioneer the industrial use of redwood. He had done important research in the drying of redwood lumber for the California Redwood Association, and was an officer in the Forest Products Research Society.

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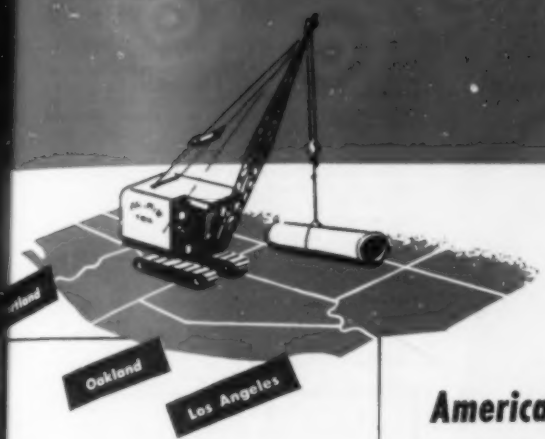

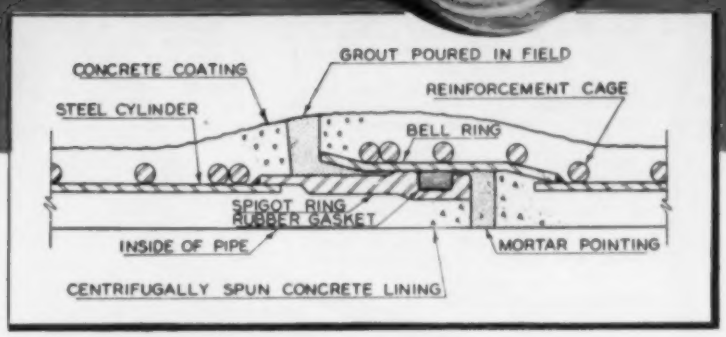

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STRUCTURAL ENGINEER; Jun. ASCE; registered; 33; married. M.S. degree in structures; 8 years varied construction experience. Desires position with structural engineering firm engaged in design, construction of industrial buildings, public buildings, bridges and/or other structures. Enjoy both board work and field supervision. Do thorough, conscientious work. Available September 15. C-519-120C.

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STRUCTURAL ENGINEER: M. ASCE; registered; 38; married. B.S., M.S., M.A., C.E.; 12 years' varied experience in bridges, buildings, water treatment plants, oil refinery structures and equipment, and engineering teaching. Presently employed by foreign government as consultant. Available on two weeks' notice. Desires permanent position of responsible character. Will consider teaching position. C-525.

Positions Available

TEACHING PERSONNEL. (*c*) Instructor in civil engineering, for materials testing laboratory. (*d*) Instructor in civil engineering, for materials of engineering and reinforced concrete. Y-2620.

ENGINEERS. (*a*) Project Manager, either civil, electrical, or mechanical graduate. Must be an exceptionally good administrator, to take complete charge of the erection of a 200,000-kw steam electrical power plant in India. Salary, $18,000 a year, plus all traveling and living expenses. Three-year contract. Y-2622.

TEACHING PERSONNEL. (*a*) Associate Professor, civil graduate, with master's degree and some practical experience, preferably in the field of sanitation, to teach civil engineering courses. Salary, $4,400 for 9 months. Location, Texas. Y-2636-S.R5815.

PROJECT ENGINEER, 40–50, with building construction experience in suburban $50,000 to $100,000 class to take charge of real estate development, including house construction, grading, roads, utilities, etc. Salary, $7,000–$9,000 a year. Location, southern Connecticut. Y-2656.

MINING OR CIVIL ENGINEER, experienced in driving tunnels in hard rock in connection with mining anthracite coal. Four-year contract. Salary open. Location, Turkey. Y-2671.

CIVIL ENGINEER, 35–45, to supervise project engineers on building work, waste disposal, and general civil engineering design for chemical company located in the East. Write stating experience, education, and salary requirements. Y-2690.

ENGINEERS. (*a*) Architect, graduate, with substantial experience in layout work and architectural design of industrial buildings and capable of carrying out assignments with a minimum of supervision. (*b*) Structural Designer, civil graduate, with considerable experience in the design of structural steel and reinforced concrete structures to design and lay out industrial buildings. Salaries open. Location, Massachusetts. Y-2720.

INSTRUCTOR, Civil Engineering. Will teach surveying and materials testing. Salary, $2,500–$2,700 for 9 months. Location, Pennsylvania. R-5813.

DESIGNER, graduate C.E., completely experienced with underground reinforced concrete structures, knowledge of sewer construction. Will carry on work with a minimum of supervision. Salary approximately $5,100 a year. Location, Chicago, Ill. R-5845.

PUMP DESIGNER, Civil or Mechanical Engineer, graduate, 5 or more years' experience with centrifugal pump design; knowledge of hydraulics; completely informed about design of impellers for company manufacturing line of sewage treatment and water purification equipment. Salary open. Location, Chicago, Ill. R-5847.

(*a*) SALES ENGINEER TRAINEE, Civil Engineer, Architect, or Mechanical Engineer; 23–28; single preferred for manufacturer of aluminum windows and screens to sell through distributors and dealers. Must have a definite and tested aptitude for selling, a better-than-average scholastic record. Training program 15 months, comprising board work, detailing, estimating and pricing, shop and clerical work, and information regarding suppliers, dealers, and distributors. Salary, $250 a

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Graduate Civil Engineer, age 35 or under, wanted for responsible permanent position with large manufacturer of surveying and drafting instruments and associated equipment and supplies located in Chicago. Must have ability to quickly understand products of the type indicated and write accurate catalog descriptions, instruction sheets, use and care information, etc. Previous technical writing experience desirable but not necessary. Salary $3600 to $5000, depending upon length of training required. Box C.E. 182, Civil Engineering, 33 W. 39 Street, New York City.

POSITION AVAILABLE

ASSISTANT PROFESSOR, young man, graduate in architecture or architectural engineering, with training in structures. Practical experience in architecture and structures desirable. To teach courses in structural design and to assist in coordinating architectural and structural designs. Starting salary, $3600 for 9 months, with possibility of summer teaching at the rate of $1200 for the quarter. Write to:

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month to start, $275 a month after six months, $300 a month after twelve months. Merit increases thereafter. Training in Chicago, ultimately transferred to district office in U.S. (d) Sales Engineer Trainee, Civil Engineer, Architect, or Mechanical Engineer 23–28, single preferred for a fabricator of structural steel items, trade, reinforcing steel, etc., to be sold to building joists, construction engineers and users. Must have a definite and tested aptitude for selling, a better-than-average scholastic record. Training program to include indoctrination in company's shops, engineering department, and Chicago field office. Salary, $250 a month to start; $275 a month after six months; $300 a month after 12 months. Will ultimately transfer to district office in U.S. R-5852.

ARCHITECTURAL ENGINEER; graduate, license preferred; about 30; minimum of 5 years' experience with steel and concrete design on industrial and commercial buildings, bowling alley design, country clubs, etc. Informed about Chicago Building Code. Will design steel and concrete architectural layout for firm of engineers in Chicago. Salary, $350–$500 a month. R-5868.

The Engineer's Stake in Labor Legislation

(*Continued from page 49*)

collective bargaining even under the Taft-Hartley Act. The young man who enters the modest-size organization of a consulting engineering office usually will never give it a thought. It is not that sort of man with whom we are concerned. He has ready and close contact with his employer and no doubt would much prefer to depend solely on his own abilities and initiative than submit to and be dependent upon group action for his advancement.

However the situation is quite different in large industrial and manufacturing establishments, which the Societies particularly had in mind when they advocated the professional employee provisions of the Taft-Hartley Act. Because of the rapid technological development of the last two or three decades, it is common to find hundreds of young scientists and engineer employees in one company. Obviously, there is not much opportunity for these men to maintain personal relations with their management. Experience has indicated that there are manifest advantages to both management and employees in a program which provides for full discussion between management and representatives chosen by the employees, regarding problems of common concern. It appears that group action by professionals does have its place. What we are concerned about is that professional employees be permitted by law to decide upon their own course without interference from others who have little understanding of their aims and standards.

It is earnestly to be hoped that whatever collective bargaining may be undertaken by engineer employees will be kept on a high plane. For action under the Taft-Hartley Act or any modification of it to be successful, or even tolerable, collective bargaining must be conducted in straightforward, dignified fashion, compatible with the ideals of professional people. Undue stratification of personnel, or regimentation of performance should be avoided. Initiative and ambition of individuals must not be stifled. Tactics which tend to build antagonisms between employers and employees are to be deplored. It appears to be true that some of the engineering groups formed to date have conducted themselves appropriately and in a manner beneficial to both employers and employees. That is as it should be and if future activity is kept in the hands of good leaders, results can continue to be constructive.

Too often, labor and management seem to have lost sight of the fact that they must have a common ultimate goal if their enterprises are to succeed. When either fails to realize that the expediency of gaining some immediate objective falls short of best serving the general welfare, both suffer in the long run. Employers and employees alike have obligations to themselves, to each other, and to the community.

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New Publications

Corrosion Studies. Results of studies of corrosive attack on metallic and non-metallic pres ure relief wells, forming part of the toe-drain system for Sardis Dam, Mississippi, are reported by the Waterways Bxperiment Station in Technical Memorandum No. 3-287. The study, which is based on chemical analyses and examination of many of the corroded wells, was performed for the purpose of identifying the source of the principal corrosive agents and of determining the reasons for certain variations in attack. Data derived from the studies were correlated with the soil profile of the dam foundation. The bulletin may be purchased from the Waterways Experiment Station, Vicksburg, Miss., at $1 a copy.

City Planning. Land use studies, made by the Cleveland City Planning Commission as a step toward its primary goal of completing a general plan for the city, are described in its annual report for 1948. Inquiries concerning the report, which is entitled *Planning Cleveland*, should be addressed to the City Planning Commission, 501 City Hall, Cleveland 14, Ohio.

Reclamation. The U.S. Bureau of Reclamation is inaugurating publication of a series of engineering monographs. At present available in the series are Engineering Monograph No. 1, *Petrography and Engineering Properties of Ingneous Rocks*, by Richard C. Mielenz, and Monograph No. 2, entitled *Multiple Correlation in Forecasting Seasonal Runoff*, by Perry Ford. Both are on sale at the Denver, Colo., office of the Bureau at 25 cents each.

Mineral Aggregates. An annotated bibliography on mineral aggregates has been issued by the Highway Research Board as Bibliography No. 6. Compiled for the Board's Committee on Mineral Aggregates by Fulton K. Fears, Jun. ASCE, of the Purdue Joint Highway Research Project, the bibliography represents a joint research project of the Board and Purdue University. Inquiries should be addressed to the Highway Research Board, 2101 Constitution Avenue, Washington, D.C.

Sewers, Specifications. Announcement of the availability of a complete revision of *Section J—Standard Specifications for Public Works Construction*, prepared by the 1948 Committee on Sewer Specifications of the American Public Works Association, has been made by the APWA. Copies may be purchased at $1 each from the American Public Works Association, 1313 East 60th Street, Chicago 37, Ill. A 40 percent discount is available to APWA members.

Sheet Piling. Detailed information on the various types of steel sheet piling, produced by the United States Steel Corp., is presented in a current publication of the Carnegie-Illinois Steel Corp., entitled *U.S.S. Steel Sheet Piling*. Another of the organization's current publications, *Design Extracts from Former Catalogs*, makes available steel sheet piling data assembled in the early nineteen thirties when such piling was a relative innovation in the United States. The material in the latter booklet has been reprinted from the publication, *Carnegie Steel Sheet Piling*, which is now out of print. Inquiries should be addressed to the Carnegie-Illinois Steel Corp., in either Pittsburgh, Pa., or Chicago.

Land Acquisition and Control. Bulletin No. 18 of the Highway Research Board, entitled *Land Acquisition and Control of Highway Access and Adjacent Areas*, includes a committee report and four papers sponsored by the Board's Committee on Land Acquisition and Control of Highway Access and Adjacent Areas and presented at its 28th annual meeting. The papers are "The Highway Right-of-Way Problem," by Frank G. Balfour; "Application of Mathematics to Right-of-Way Appraisal," by Harrison W. Hill; "Federal Participation in Right-of-Way Acquisition Costs," by Lester E. Boykin; and "A Practical View of Urban Right-of-Way Acquisition," by J. L. Dickson. The Bulletin may be obtained from The Highway Research Board, 2101 Constitution Avenue, Washington, D.C.

Water Resources. Results of hydrometric investigations in British Columbia, Alberta, Saskatchewan, Manitoba, the Northwest Territories, and western Ontario for the climatic years 1943–1944 and 1944–1945 are reported by the Dominion Water and Power Bureau in Water Resources Paper No. 97. Copies, priced at $1 each, may be obtained from the Dominion Water and Power Bureau of the Canadian Department of Mines and Resources, Ottawa, Canada.

Steel Research. Issuance of several new sections in the Steel Products Manual, which is being published in installments by the American Iron and Steel Institute, has been announced by the Institute. Now available are Section 5 on "Steel Sheet Piling"; Section 9, covering "Cold Finished Carbon Steel Bars"; Section 14, which deals with "Tin Mill Products"; Section 15, on the subject of "Hot Rolled Carbon Steel Wire Rods"; and Section 29, entitled "Cold Finished Alloy Steel Bars." Copies may be purchased from the Institute, 350 Fifth Avenue, New York 1, N.Y., at 25 cents each.

Steam Power. Planning, design, construction, and initial operation of the Watts Bar Steam Plant are discussed in detail in Technical Report No. 8 of the Tennessee Valley Authority. The 380-page report includes a summary of project costs, a complete statistical summary of physical features, and a list of major purchases of material and equipment. There are 123 illustrations and 56 drawings and diagrams. Copies may be purchased from the Tennessee Valley Authority, Treasurer's Office, Knoxville, Tenn., for $2.25.

Geology. A revised price list of the publications of the Division of Geology of the Indiana Department of Conservation, 1919–1949, and of its predecessor organizations going back to 1859 has been made available by the Department. Inquiries should be addressed to the Publications Office, Division of Geology, Owen Hall, Bloomington, Ind.

Screw Threads. The new American standard on *Unified and American Screw Threads for Screws, Bolts, Nuts, and Other Threaded Parts* was recently published by the American Society of Mechanical Engineers, under joint sponsorship of the ASME and the Society of Automotive Engineers. This standard, which has been approved by the American Standards Association, is the American fulfilment of the unification of screw threads agreement made last fall by British, Canadian, and American representatives. Copies of the 100-page publication may be purchased from ASME, 29 West 39th Street, New York 18, N.Y., at $3. A discount of 20 percent is available to ASCE members.

Highway Bridges. A revision of the 1944 specifications for highway bridges of the American Association of State Highway Officials, recently issued by the AASHO, contains all revisions adopted up to April 1, 1948. Important changes have been made in the Division on Design, including the revision of axle loads on floors, clarification of the application of live loads, distribution of loads, and an improved specification on the bearing value of piles. Copies may be purchased from the AASHO, 1220 National Press Building, Washington, D.C., at $3 each (foreign postage extra).

Erosion Control. Numerous aspects of the soil erosion problem are covered in a publication of the Government of Madras, India, entitled *Soil Erosion—Its Prevention and Control*. The 184-page compilation is illustrated with photographs of the most common types of erosion and of some of the corrective installations being tried by the government, including check dams, storage and retarding reservoirs, and wind brakes. Varied experiments with planting are also described. The volume, priced at 6 rupees, may be obtained from the Government of Madras, Madras, India, or from the office of the High Commissioner for India, India House, Aldwych, London W.C. 2.

Concrete Construction. As the first of a projected series describing the design, uses, and advantages of pre-stressed concrete in modern construction, Preload Enterprises, Inc., has issued a booklet on preload wire-wound concrete tanks. The publication details the history, design, and construction of such tanks, and gives complete specifications for building them. Copies may be obtained free of charge from Philip Boyer, Jr., Advertising Manager, the Preload Corp., 211 East 37th St., New York 16, N.Y.

Corrosion Studies. Results of an investigation of the resistance of monel, nickel, and high-nickel alloys to corrosion by sulfuric acid are described in Technical Bulletin T-3 of the International Nickel Co., Inc. Inquiries should be addressed to the Development and Research Division of the company at 67 Wall Street, New York 5, N. Y.

Mosquito Control. In its annual report for 1948, the Alameda County (California) Mosquito Abatement District reports that exceptional progress was made during the year in its long-range program of mosquito control. Harold F. Gray, M. ASCE, engineer and executive officer for the district, is in charge of the abatement program, which is completing its eighteenth year of operation. Inquiries should be sent to the Alameda County Mosquito Abatement District, Court House, Oakland 7, Calif.

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Air-Entrainment Decreases Scaling on Ohio's Highways

(*Continued from page 33*)

amount of scaling developed on 4 of the 15 projects as a result of one winter's exposure.

A similar analysis of field tests for air content of concrete placed during the major part of the 1948 construction season shows that the range in air content which would probably occur for 99 tests out of 100 was somewhat higher than that found for the 1947 construction. Further, the number of times out of 100 tests that the air content could be expected to fall below 3 percent was reduced to 5, or approximately half the corresponding probability value for 1947 construction. It should be noted that whenever the air content of the concrete on any project falls below 3 per cent, corrective measures are taken immediately.

The 1945 and 1948 inspection data, supplemented by the study of air content data, show the continuous progress that has been made toward the realization of scale-resistant concrete pavement through air-entrainment.

Prestressed Concrete Used for Structures in Europe

(*Continued from page 27*)

are made in cast-iron molds, into which 8 high-tensile-strength wires are laid and prestressed with jacks prior to placing the concrete. Each mold, with the 8 prestressed wires held in place against the mold by lock nuts, is transferred by crane to a constantly vibrating table where it is filled with concrete. After screeding off, each mold is moved to a steam curing chamber.

Advantages of Prestressing Reviewed

Prestressing is an entirely new application of old materials. There are several good systems with which American engineers should familiarize themselves. This method of construction is applicable to some situations for which no other solution seems satisfactory, and has advantages that are being utilized by European engineers in a great variety of projects. Concrete as manufactured for prestressed construction is carefully designed, mixed so dry that there is no slump, placed by the extensive use of both internal and external vibrators, and usually steam cured. Advantages which appeared evident to us were that prestressing saves dead weight, prevents concrete

cracks, saves steel, saves concrete, saves depth of beam structure, increases resistance to flexure, resists fatigue of reinforcing steel, and saves time and money.

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Skillful Design and Careful Administration Cut Airport Costs

(*Continued from page 44*)

causes for exceeding the budget include the omission of vital elements in the plans and specifications, such as a required culvert or a taxiway connection, and failure to make adequate allowance for natural conditions. These conditions result from such causes as the occurrence of subsoil conditions which render excavated material unsuitable for embankments, as for instance the discovery of pockets of hidden dump backfill; or the discovery of pockets of peat or other unsuitable material underneath the areas to be used for runways. Both of these occurrences might cause unforeseen undercutting and consequent infringement on the budget.

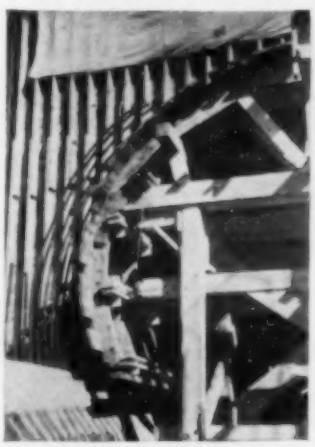
The importance of adequate preliminary soil exploration and also laboratory analyses of materials which are to be used should not be underestimated. Economy in short-circuiting soil investigations and the use of structurally inferior material are apt to prove expensive.

Acknowledgments

For help in the preparation of this article the writer wishes to give credit to the following: William E. Cullinan, Jr., of the Civil Aeronautics Administration; Francis Carroll, Director of Public Works, Monroe County, New York, in general charge of the Rochester construction; and Simon P. Carman, M. ASCE, associated with the writer's firm on the Broome County Airport. This airport was sponsored by the Broome County Board of Supervisors, F. Clyde Eggleston, Chairman. Conrad & Cummings were the architects for the Administration Building. Both these airports were designed and supervised by Seelye, Stevenson & Value, Consulting Engineers.

BUILDERS OF SAN ANGELO DAM USE HYDRON ON CURVED FORMS

Shown at the right is a tunnel section of the San Angelo Dam, San Angelo, Texas. The concrete was cast against Hydron Form Linings which provide a smooth, pit-free surface, enabling the concrete to withstand the grinding action of high-velocity silt-laden water.



Using a curved hinged form on the upper 300° with Hydron Form Linings. Hydron can also be used on lower 60°. After floating concrete apply Hydron and weight down with 2" of sand.

Hydron absorbs excess water and eliminates trapped air from the surface. This makes the concrete several times more resistant to abrasion and freeze-thaw conditions. The case hardening effect is gradual from the surface into the mass for about an inch.

Other big installations on which Hydron was used are: Fall River Dam, Norfork Dam, East Sidney Dam, Whitney Dam, Cherry Creek Dam, Soo Canal and lock walls, Chain O' Rocks Canal, Delaware & Chesapeake Canal bridge abutments, Maine Turnpike bridge abutments.

Contractors using Hydron report that the total cost including a satisfactory profit ranges from 12¢ to 16¢ per square foot.

For more information write Hydron Sales Department, United States Rubber Company, 1 Market Street, Passaic, N. J.

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EQUIPMENT, MATERIALS *and Methods*

NEW DEVELOPMENTS OF INTEREST, AS REPORTED BY MANUFACTURERS

Junior Beams

SAVINGS OF APPROXIMATELY one cent per lb by use of junior beams, the lighest weight hot-rolled steel beams in commercial use, for roof purlins, are reported in construction of a new industrial building. Installation of truss-type steel joists with fixed ends would have required a costly second operation after the frame of the building was erected. Truss-type joists would have to be spread out and positioned manually, then welded into position. If

Roof Purlins

bolted into position, special end attachments would have increased the cost differential. After junior beam purlins were erected, sag rods of $^5/_8$-in. steel rounds threaded at the end, were installed and bolted for additional lateral rigidity. Steel roof decking was welded directly to the beams. The decking was then covered with a layer of tar-and-slag for further insulation and protection. Approximately 900 ft of 10-in. junior beams and 1,350 ft of 12-in. junior beams were used in the roof purlins. The lightweight of the beams facilitated their handling during fabrication and erection. One 10-in. purlin, 16 ft long, weighs less than 150 lb. The safe load, uniformly distributed for this beam, is nearly three tons. Junior beams can be notched at various depths to obtain roof slope. **Jones & Laughlin Steel Corp., Pittsburgh 30, Pa.**

Sulmet Rock Bit

DEVELOPMENT OF A NEW Joy Sulmet rock bit, designed for general drilling application, has been announced. It is a skirt-type bit of the four-point cross design with tungsten carbide inserts for maximum penetration. It is available immediately in sizes as follows: $1^3/_8$, $1^1/_2$, $1^5/_8$, $1^3/_4$, and $2^1/_4$ in. Other sizes will be made available at a later date. **Joy Mfg. Co., Henry W. Oliver Bldg., Pittsburgh 22, Pa.**

Mechanically Cleaned Unit Screen

A COMPLETELY NEW DESIGN in a mechanically cleaned bar screen with grinder for sewage plants is announced. This unit is fully automatic, and is adaptable for minimum channel widths and settings, or for parallel multiple installations for large flows. The smooth steel frame is easily inserted into slots formed in concrete channel walls, with only four bolts to mount the screen on the operating floor. The total height of this unit from mounting floor is only 5 ft. The entire above-floor structure is enclosed with stainless steel panels secured by special quick-opening spring-lock fasteners, where necessary, to permit easy access to the mechanism for inspection, adjustment, and repair. Each unit is furnished with completely automatic electrical control. Water-level control electrodes are mounted in the upstream channel to insure positive starting of the screen cleaning mechanism whenever an accumulation of debris causes a significant difference in water level at the screen. A limit switch stops operation with the rake out of the flow, when time control of water level control cycles have been completed. For detailed information, write for technical supplement MS 1-6. **The American Well Works, Aurora, Ill.**

Chain Saw

THE LATEST ADDITION to the complete line of Timberhog portable power saws is the Timberhog 36-in., gasoline-driven chain saw, especially designed for rapid and efficient cutting of heavy timber by lumbermen, farmers, contractors and others. Powered by a two-cycle, 4.2-hp engine, the 2-man saw features an antifriction ball-bearing idler at the helper's end, which provides greater use of the horsepower produced and insures faster

Portable Power Saw

cutting. Compact design and the use of strong diecast aluminum parts result in extremely light weight for a saw of this capacity. Complete with guide bar, chain, guard and helper's end, this 36-in. saw weighs only 65 lb. **Dept. H. 48, Reed-Prentice Corp., Worcester 4, Mass.**

Tilting Concrete Mixer

A NEW $3^1/_2$-CU FT tilting concrete mixer of the end-discharge type is announced. Designed for convenience and time saving, this unit provides for discharging directly into forms and for easy spotting on the job. Powered by a Model 9R6 Briggs and Stratton air-cooled gasoline engine with the latest easy starting features, it is driven by a heavy roller chain on accurate cut tooth sprockets. Disk wheels are equipped with Timken bearings and 5.50

Mixer Unit

× 16 tires. Two supporting legs provide a stabilizing four-point suspension which prevents twisting strains. In towing, the large wheels and a 56-in. wheel tread permit high speed without danger of tipping. Literature is available. **Muller Machinery Co., Metuchen, N.J.**

Air Tools

A CLAY DIGGER, a trench digger, and a breaker are three newly designed Blue Brute air tools for the construction equipment field. The tools feature refinements in design and manufacture, and include a four-bolt handle, built-in lubricator, replaceable bronze cylinder bushing, replaceable chuck bushing, and interchangeable handles. Two major advancements are incorporated in the new design: a streamlined latch-type retainer, enables trimming and breaking in close quarters without damaging the retainer fulcrum pin because there are no side projections; and a new, simple metering-type valve which is unaffected by wear. The new design provides larger bearing surfaces and shorter piston travel, which lengthens the life of the tools. Complete specifications available by writing for Bulletin No. H1200-B37. **Worthington Pump & Machinery Corp., Holyoke, Mass.**

Equipment, Materials & Methods (Continued)

Drill Unit

IN REMOVING THE OUTER two of four sets of streetcar tracks in preparation for resurfacing, this unusual unit is employed to line cut along curbs and tracks before excavating. Cutting of the asphaltic concrete surface and concrete base material was done by a row of 3-in., automatic-feed, drifter drills, mounted in quickly adjustable saddles on a heavy

Automatic-Feed Drifter Drills In Operation

crossbar. By using a "new standard" Jaeger 600-cu ft compressor on the unit, instead of an ordinary standard 500 cu ft, the contractor was able to add a fifth drill, thereby increasing his daily length of cut 25 percent. A row of five $2^1/_8$-holes, 12 in. apart, was drilled in about 30 sec. The truck was then shifted 6 in. and a second series of holes drilled between, and one hole beyond, the first series before the truck moved on to the next drilling position. This preparatory cutting prevented over-break on the pavement when excavating. Catalog No. GC-9 covers Jaeger's complete line of equipment. **The Jaeger Machine Co., Columbus 16, Ohio,**

Plaster-Mortar Mixer

A 10-CU FT PLASTER-MORTAR mixer to meet high volume production demands of contractors on large construction projects has been introduced. Adding the Model 10-P expands the extensive Kwik-Mix line of concrete, bituminous and plaster-mortar mixers. Mounted on two wheels with extra wide treads for fast, easy towing, the mixer is a non-tilt, end-discharge type. A push-down tow pole feature makes handling the machine easy for on-the-job movements and prevents tipping. The low charging height of 46 in., which is unusual for this size mixer, makes it easy to load and reduces manual effort. The mixer is equipped with anti-friction bearings throughout. Paddle shaft bearings are mounted outside the drum to prevent material from working into them. A 15-hp air-cooled engine furnishes power for the mixer and the 800-lb capacity hoist for delivering batches above ground level. The hoist is optional equipment. **Kwik-Mix Co., Port Washington, Wis.**

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The effectiveness of Koppers Fire-Retardant Wood has been dramatically demonstrated under actual fire conditions, as well as in exhaustive tests conducted by the Underwriters' Laboratories, Incorporated.

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Equipment, Materials & Methods (Continued)

Arc Welder

A NEW AC TRANSFORMER arc welding machine, known as the Wilson 200 Ampere Max. MCT has been announced. According to the manufacturer, this economical, portable welder was specifically designed for use by small shops, garages and maintenance crews. It has a rated maximum output of 200 amperes and is completely self-contained. Welding range is divided into two ranges of current adjustment with stepless control throughout each range. Capacitors are supplied in the secondary circuit to provide easy arc starting and arc stability. Full view scale makes current settings easy to read. Windings are fully insulated with heat-resistant spun-glass fibre. A primary "on and off" switch and a 10 ft length of three conductor rubber covered primary cable with lugs attached are included with the machine. **Air Reduction Sales Co., 60 E. 42 St., New York 17, N.Y.**

The Wilson 200 Ampere Welder

Standard Tandems

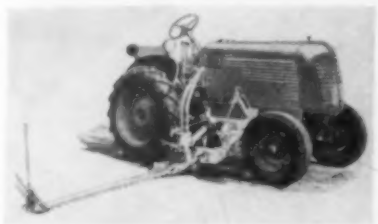
THREE NEW VARIABLE weight tandem roller models—the KT-14 with variable weight range of 5 to 7 tons—the KT-19 from 8 to 12 tons, and the KT-20, 10 to 14 tons have been manufactured. Furnished with either gasoline or diesel engine, the new models have many of the basic features of the well-known "B" series or heavy-duty tandems. A gear-type oil pump supplies the low-pressure hydraulic

(*Continued on page 97*)

steering system, while two high speed-low torque clutches permit reversing the roller without shifting gears. A single-unit engine transmission and bevel gear final drive provides a simplified compact power train. Side air intake for the engine, and an all-welded frame are other features. A self-energizing hand-operated scarifier is available as optional equipment. Write for catalogue S-57-49. **The Buffalo-Springfield Roller Co., Springfield, Ohio.**

Hydro-Mower

THE HYDRO-MOWER, a smooth operating, long-lived unit, uses a heavy-duty hydraulic pump capable of continuous operation and delivery of at least 15 gpm at 800 lb at 1500 rpm. The pump operates the power hydraulic curb and bar lift which gives the mower a curb lift minimum of 18 in. and a bar lift which makes it possible to operate the cutter bar in a position 55° below horizontal to 95° above horizontal.



In addition, a hydraulic motor operates the cutter bar unit, optional with 5- and 6-ft lengths, which has 3-in. underserrated sections and heavy-duty rock guards. The outstanding feature of this unit lies in its smoothness of operation and the fact that even though the initial cost may be somewhat higher, the cost per mile of operation and repair should be considerably less than mechanical mowers of today. **Oliver Corp., Chicago, Ill.**

Chain Belt Products

A 56-CU FT CAPACITY stationary mixer, known as the Rex 56S, has been manufactured. Among the many features employed in the mixer, the most outstanding are the high-carbon steel drumhead liners, center sheet, blades and buckets, manganese steel drum rollers and accurate water system.

A 3-YD HORIZONTAL moto-mixer contains all the features that have made the 4½ yd and 5½ yd horizontal sizes so well known for dependability, low maintenance costs and delivery of high quality concrete. These features include chain drum drive, free-rolling drum mounting, accurate water system and trouble-free and versatile spouting. For further information on these products write for booklet 56S and Spec. Horizontal-49. **Chain Belt Co., 1600 W. Bruce St., Milwaukee 4, Wis.**

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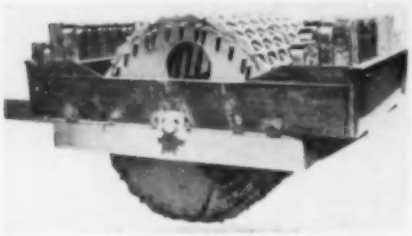
Equipment, Materials & Methods (Continued)

Earth Compactor

ENTIRELY DIFFERENT in both principle and appearance from the commonly used sheepsfoot and rubber tire rollers is the new grid roller. It consists of two 5-ft dia rollers attached to a frame which is towed behind a tractor or motor grader. Each roller is 32 in. in width and made of ten replaceable sections of heavy, heat-treated alloy steel grid segments bolted onto circular side plates. These grids have the appearance of a woven, open-mesh grid made by interlacing $1^1/_2$-in. round bars. Openings between adjacent bars are $3^1/_2$ in. square. There



Grid Roller

are no projecting teeth to uproot surfaces previously compacted. The increased compaction per pass makes fewer passes necessary to meet required specifications. In addition to its use as an earth compactor for airports, dams, leaves, fills, road building, etc., the grid has another main purpose, that of salvaging and maintaining bituminous or black top pavement. After the scarifying has been done, the roller breaks up and partially pulverizes road mix pavements, compacts the sub-grade after the old pavement has been windrowed to the side, and then later compacts the fill of replaced broken-up black top preparatory to final surfacing. Additional information may be obtained by requesting form number 1126. **Hyster Co., Portland 8, Ore.**

Rotary Pump Line

AN IMPROVEMENT IN DESIGN features on Worthington rotary pumps by the incorporation of a new line known as Gami has been announced. The new pumps employ the use of a mechanical seal and a self-lubricating type inboard sleeve bearing to carry overhung drives. The seal and bearing assembly are interchangeable on the same shaft with the standard stuffing box of the GA type pump, so that if service conditions change, substitutions of seal or stuffing-box can be easily made. The seal is subject to suction pressure only, and has been found tight even at high vacuum. It is ideally suited to installations requiring high vacuum and a drip-proof construction, are designed for handling liquids comparatively free from abrasive or corrosive substances, and are capable of handling a considerable amount of air or gas in the liquid. Write for Bulletin W-484-B-1. **Worthington Pump & Machinery Corp., Harrison, N.J.**

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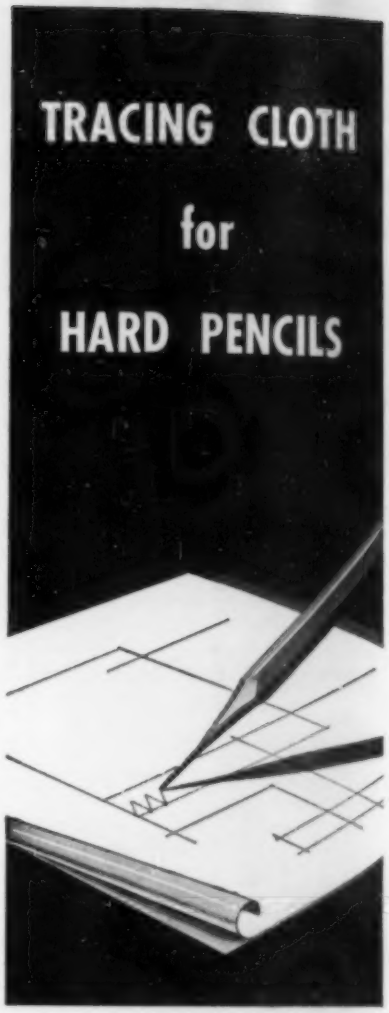

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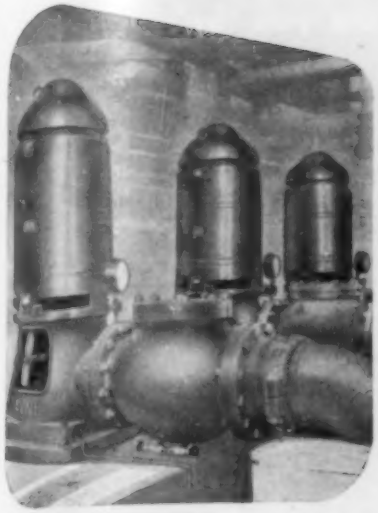

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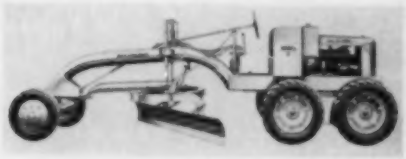
Equipment, Materials & Methods (Continued)

Motor Grader

A COMPLETELY NEW 34.7 hp. Model "D" motor grader has just been announced. This rugged 8,500-lb machine introduces to the low-priced grader field, several popular accepted big grader features such as tandem rear-wheel drive, tubular frame design, and rear-mounted engine-transmission construction for improved visibility. It has been specifically engineered for low cost maintenance and light construction work, and is particularly designed to economically meet the needs of governmental bodies, contractors, loggers, mine operators, industrial plants, airports and railroads. A smooth flexible gasoline engine is another distinguishing feature of the power-packed Model "D." Valve-in-head design, high compression and heavy duty magneto assure maximum engine efficiency and operating economy. A high capacity water pump circulates water through the head and engine block while all bearing surfaces are supplied with oil circulated by a high-pressure oil pump. **Allis-Chalmers Mfg. Co., Tractor Div., Milwaukee 1, Wis.**



Model D Grader

Flexible Steel Face Forms

ARTICULATED FLEXIBLE steel face forms for curb and gutter construction simplify the work of forming a battered curb face and accommodate any reasonable size radius. The construction of combined concrete curb and gutter has always presented the contractor with the problem of providing suitable forms for not only the tangent work, but also for the radius at driveways and street intersections, also on curved parkways. A new approach to this problem is presented by the articulated flexible steel face forms. These consist of straight, rigid sections one foot long, all identical. A 10-ft length is made up of ten such sections and a 5-ft length is made up of five sections. The sections are assembled on to a steel cable, the cable passing through eyelets welded to the 1-ft sections at both ends. Attached to one end of the cable is an I-bolt which ties to the outside eyelet of one of the end sections. The opposite end of the cable is simply anchored to the opposite end section with a cable clamp. For the back of the curb and the face of the gutter, standard flexible steel forms are used and set in the usual manner. **Blaw-Knox Co., Blaw-knox, Pa.**

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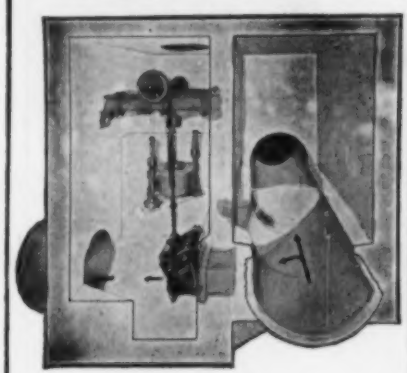

Fig. B-19

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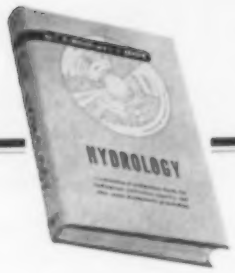

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Equipment, Materials & Methods (Continued)

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Generator Sets Specially Designed for on-the-job Operation

Wood Preservative

THE PRESENT COST of lumber and of millwork, such as windows and doors, is high. That is one reason why more and more users of wood are insuring themselves against premature replacement resulting from decay, by the use of wood preservative on wood before and during erection. Tremco wood preservative, recently developed by the Tremco Manufacturing Company's laboratories, offers a double-action treatment that prevents wood from rotting, keeps moisture out and reduces the possibility of shrinking and warping of wood. Any wood material can be treated, either in manufacture or at the time of installation. Simple application is made either by impregnation, dipping, brushing or painting. **Tremco Mfg. Co., 8701 Kinsman Road, Cleveland, Ohio.**

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New York 17, N. Y.

Literature Available

CORROSION—"Fighting Corrosion with Corrosion" is the title of Technical Publication 103. The attractive 10-page booklet thoroughly discusses corrective measures, the cathodic protection battery, design and application, acceptance and cost. Several diagrams and pictures are included. **Electro Rust-Proofing Corp., Belleville, N.J.**

TYPE H-METER—Bulletin No. 400 offers useful information on the the type H-meter, which is able to change the maximum possible flow measurement through a given size orifice merely by the substitution of a different float in the instrument. The bulletin contains operation and construction data, accompanied with pictures, diagrams, charts and specifications. **Simplex Valve & Meter Co., Philadelphia 42, Pa.**

TRAYLOR EQUIPMENT—An 8-page bulletin, designated as 4120, offers detailed information on gyratory, reduction and jaw crushers; crushing rolls; feeders; ball, rod, tube and compartment mills; rotary kilns and other equipment used for mining, milling, smelting, concentrating and refining. The booklet is profusely illustrated with photographs, charts and diagrams. **Traylor Engineering & Mfg. Co., Allentown, Pa.**

DRAINAGE STRUCTURES—A booklet of interest to anyone specifying or designing drainage structures has just been published. Entitled "Engineering Data—Toncan Sectional Plate Pipe, Pipe-Arch, Arches," it contains essential design and estimating information on new sectional plate drainage products with 2-in. corrugations. Profusely illustrated, it is a compact 16-page manual including tables needed by the engineer in his work. **Advertising Div., Republic Steel Corp., 3100 E. 45 St., Cleveland 4, Ohio.**

OPERATING COST GUIDE—A 24-page booklet is offered as an aid to the owners of power cranes and shovels in correctly estimating the cost of ownership, operation and maintenance of this type of equipment. Charts and diagrams are included in the booklet. Copies of this pamphlet, "Technical Bulletin No. 2," may be obtained for fifty cents each. Complementary copies will be furnished to engineering schools and colleges. **Power Crane & Shovel Assoc., 74 Trinity Place, New York 6, N.Y.**

TURBINE PUMPS—A Johnston turbine pump for every water transfer job in the wide ramification of industrial operations is the theme of two interesting and well-illustrated booklets recently relased. The text deals with the many applications for which pumps are designed; explains how interchangeability of parts still further extends their utility and economy; and by means of sectional drawing shows the component parts of the pumps, their relation to each other, and the modus operandi of the complete mechanism. Bulletin 1013 deals with oil-lubricated pumps, and Bulletin 1014 explains the water-lubricated pump. **Johnston Pump Co., Los Angeles 11, Calif.**

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Literature Available (Continued)

DICALITE—A new data sheet on "Dicalite in Concrete Construction" is now available upon request. Dicalite in concrete construction helps make concrete more uniform. It is a lightweight powdered material, packaged in bags, and is added at the mixer with other dry material. **Great Lakes Carbon Corp., Bldg. Products Div., 18 E. 48 St., New York 17, N.Y.**

VALVES—A new folder, Circular 101, describing the Kennedy bronze globe and angle valves with renewable composition disks is offered free upon request. The folder is well illustrated with photographs of all the important construction features of this line of valves, recommended for services up to 150 lb steam or 300 lb cold water, oil, air or gas. **Kennedy Valve Mfg. Co., Elmira, N.Y.**

WOOD PRESERVATIVES—A folder containing information on chemical wood preservatives has been issued. Designed to give general information on several of their products, including Penta preservative, Ambrocide, Permatox 10-S and Permatox WR, the bulletin has been printed in both English and Spanish. Title of the folder is "How to Protect Wood Chemically." **Chapman Chemical Co., 770 Dermon Bldg., Memphis 3, Tenn.**

ANTI-BACTERIAL CEMENT—An 8-page folder describes a brand new product, North American anti-bacterial cement. With this sensational, completely new cement, ordinary methods may be used to make concrete that actually kills bacteria and fungi on contact and retains that power. The folder contains detailed results on actual tests as well as laboratory tests. **North American Cement Corp., 41 E. 42 St., New York 17, N.Y.**

INDUSTRIAL BUILDINGS—A new 8-page illustrated catalog describes the Rigidsteel design principle for economical building construction. Rigidsteel design affords speedy construction without a network of trusses. Special applications for industrial, municipal or commercial buildings—either conventional or eccentric in design—are discussed in full. **McCloskey Co. of Pittsburgh, 3400 Liberty Ave., Pittsburgh 1, Pa.**

CENTRIFUGAL PUMPS—A 16-page bulletin gives the how and why of pump construction and their effect on pump maintenance. The booklet tells how to figure ahead; it carries tables to help determine total friction loss. Causes and cures for various sources of troubles are offered along with a maintenance timetable. Copies of "Handbook for Care of Centrifugal Pumps," 08X6256A, are available upon request. **Allis-Chalmers Mfg. Co., 1187 S. 70 St., Milwaukee, Wis.**

H-PILING—Catalog No. 223, incorporating in its contents useful information on dimensions and properties of H-piling, their characteristics, safe loads and design data, how to drive and driving formulas, load tests and test data, general specifications for H-piling, life expectancy of, designs of installations where H-piles were used has been issued. In all, 102 pages of text, illustrations, drawings and charts. **Publications Dept., Bethlehem Steel Co., Bethlehem, Pa.**

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